Translating Teacher's Manuals into Digital Presentations:

PowerPoint Presentations as Educative Curriculum Materials

by

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ABSTRACT

This action research study primarily examined how educative curriculum materials (i.e., curriculum materials that include supports for teacher learning) can improve a teacher's knowledge base and ability to succeed in the classroom. The focus was on the impact of one type of educative curriculum material: PowerPoint presentations. Specifically, the study investigated if translating teacher's manuals into digital presentations was valued by general education teachers responsible for teaching Engage NY math in kindergarten, first, second, and third grades. The study asked teacher participants to describe the impact (if any) of adding a digital presentation component to their lessons and investigated if they self-reported increased Pedagogical Content Knowledge (PCK), which is a teacher's understanding of how to help students understand specific subject matter. Using questionnaires, interviews, and field notes, the following research questions were examined: 1) How do teachers describe the impact that pre-made digital slide share presentations (i.e., PowerPoint presentations) have on lesson planning, preparation, and pacing and 2) What impact does translating teacher's manuals into digital slide share presentations (i.e., PowerPoint presentations) have on teacher's pedagogical content knowledge? Results indicate that teacher participants found the presentations to be helpful and positively impacted their lesson planning, preparation, and pacing, and improved their perception of their own abilities when presenting Engage NY math content.

DEDICATION

This is dedicated to my husband, Gregg. Thank you for your never-ending support and for always believing in me.

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Background

My journey to become an educator was atypical. I did not realize it was my calling until twenty years after I earned my bachelor’s degree. Once I realized my passion was teaching, I quit my private sector job and returned to school to earn my Master’s in Education. I was still in school doing my student teaching when a position opened for a first-grade teacher. Of course, as a new teacher, I was thrilled to have my own classroom and thought I would be able to handle whatever was thrown at me with ease. I was wrong.

While I theoretically understood what my responsibilities would be as a classroom teacher, I had never actually assembled a complete list. I quickly learned that an elementary school classroom teacher’s responsibilities include (but are not limited to): teaching every lesson, every day for every subject; ensuring that all students are learning and that the material is differentiated for higher and lower ability students; meeting the social and emotional needs of all students; communicating with parents; communicating with administration; remaining current on grading student work and updating the gradebook; sending home behavior notices (positive and negative); creating lesson plans; preparing materials; making copies (there are no workbooks in schools anymore, they’re too expensive); preparing for evaluations; preparing students for standardized testing; having classroom parties; planning field trips, and of course, every good teacher must be versed in all of the material they are supposed to be teaching in every subject, which may or may not change the next year.

Statement of the Problem

Aside from the responsibilities I previously listed, the classroom I inherited had students with a plethora of behavioral issues. I was overwhelmed to say the least. There was so much information that I was responsible for providing to the students and no one could really tell me what I should be teaching aside from providing me with a list of standards, which are helpful, but are not completely clear about *how* the content should be taught. In fact, the term "curriculum" has multiple meanings. It can refer to the learning objectives for students by the state or district, the set of written materials provided to teachers such as the textbook, teachers' guide, etc., or it may refer to the lesson that is enacted in the classroom (Sherin & Drake, 2009).

Instead, I was given teacher's manuals. "You'll need this manual to teach math," said my mentor teacher and plopped a 4" thick binder down in front of me. "Oh, you'll also need these to teach reading," she said handing me five enormous spiral bound teacher's manuals. "We also have the entire *Lucy Calkins* writing program that you'll need to check out from the professional development library, and of course you'll need the social studies and science teacher's manuals as well - but those are spread out in various locations and some are in bins - just see what you can find - don't worry - we'll be here for you". I never saw my mentor again unless I was having a performance evaluation.

I learned that to prepare to teach content to students I needed to read each lesson, digest all the material, review all the tips, tricks and notes about how to differentiate the content based on the types of learners that are in the classroom; and I had to do this for each subject daily. The fact was, I simply did not have the time. I can see how, for teachers who have multiple years of experience teaching the same lessons repeatedly, it might be a different situation. The teacher would retain the material over time and be more comfortable teaching without referring to the manuals. That was not my situation. As a first year teacher, I needed to know what I was supposed to be teaching and I did not have time to write lesson plans for 4 or more subjects every day.

As previously noted, teachers have many responsibilities. Research shows that most teachers do not have time to read extensive curriculum materials-no matter how useful the materials might be (Davis & Krajcik, 2005). Many teachers are not familiar with subject matter they are required to teach because either they are new to teaching or they have switched grade levels and there is not enough time to prepare and/or become a subject matter expert in every area. Remillard (2000) asserts that teachers need to continue their own learning, especially in mathematics education because "…many of the ideas central to reform efforts are foreign to today's teachers and they are being asked to teach in ways that are unfamiliar to them, ways that they did not experience as a student" (p. 332).

Unfortunately, my story is not unique. My story is not even unusual. My story is the same story thousands of teachers tell about their initiation into teaching and their first experiences working with students. I began to understand why our education system has some troubles. I had made a conscious decision to stop working in corporate America and take a very significant pay cut because I wanted to make a difference. But how, on Earth could I make any sort of difference when these were the obstacles I was facing? I was exhausted and beaten, and I had not even begun as a certified teacher - I was still working under an emergency substitute certification.

I began to look for resources to alleviate my burden anywhere and everywhere I could find them, including books, journals, blogs, YouTube, or anything that I thought might help. I kept looking for something that would help me with the material that I had to teach. Considering that I had a new lesson to present every day in reading, writing and math, I was flabbergasted to learn that no one before me had put together presentations to help guide the lessons. When I was as a corporate trainer, we worked as a team to create presentations for all the courses that our department offered. Every content area had a presentation that had been researched, prepared, reviewed, tested, and was filed in an organized system for anyone to utilize. The training department constantly had employees leave and enter, so the presentations had to be easy to use and easily decipherable so that any trainer could pick up and know where to begin instructing. However, this type of resource library was not available for the content I needed to teach in the elementary school context.

When I looked at the mountain of reference materials that was given to me, I wondered why these teacher's manuals did not come with PowerPoint presentations to guide the teachers. In my search for a solution, I came across *Teachers Pay Teachers*, an online open marketplace where teachers buy materials that are made by other teachers (https://www.teacherspayteachers.com). I located a seller who made presentations for the reading curriculum I used, and I was quick to purchase them. With those slides, I was able to relax and freely speak about the content because the cues were projected on the screen for me to follow. I had better control of the classroom because I was not referring to a teacher's manual to see what I would need to do next and could pay attention to and engage with the students.

I then started to create my own presentations for math lessons from the teacher's manuals I was given (see Appendices A, B, C, D for samples of kindergarten, 1st, 2nd, and 3rd grade lessons). The Engage NY curriculum is available online at https://www.engageny.org/common-core-curriculum and is free for anyone to access. In terms of flow and content, the presentations followed the Engage NY teacher's manuals that are found on the Engage NY website. I added additional components in the form of visual models and clip art to engage students during the lesson presentations, but the content of the presentations did not vary from the teacher's manuals. After using them in my classroom and sharing them with my colleagues to use in their classrooms, I shared them on *Teachers Pay Teachers*. I only had a few lessons posted to the website when teachers began sending demands for more. "When is the entire year going to be ready?" and "Do you have this for my grade level?" Therefore, I spent the summer creating math presentations for the entire year. The feedback I received was remarkable. In their reviews of my products, teachers were grateful for the format of the content. Comments included:

- *"Now I finally understand what I've been teaching!"*
- *This has helped me tremendously during my whole group instruction! I no longer must be attached to a book to remember the plan for the day!*
- *"Thank you for making my life EASIER! This made going through (the math curriculum) a breeze!*
- *I loved how this was step by step, I didn't even need to use my lesson plan and my kiddos loved the visuals!*

- *This has been very helpful in helping me follow the lesson without having to read the book the whole time!*
- *I feel much more natural presenting the modules, which makes it easier to keep them engaged!*

I began to think about how easy it would be for education curriculum designers to help ease some of the burden of teaching by creating something as simple as PowerPoint presentations. If each subject area was to provide a digital presentation outlining the material, the benefits would be twofold. First, teachers would be able to remove that responsibility from their own to do list and in turn, focus that energy back on the students. Second, an organized summary of the content would be more visible to the teachers and the students. Given the increasing reliance on prescribed curriculum programs and materials, including textbooks and pacing plans that dictate the pace at which teachers must ‘‘cover’’ the curriculum, the significance of curriculum materials in shaping both teachers’ practice and learning has heightened as well (Grossman & Thompson, 2008). Teachers need educational curriculum materials that guide their teaching and help them learn as well as the students.

Curriculum Materials

Almost every K-12 school has a required curriculum for most subjects. In any given classroom, that curriculum is typically presented to students by teachers using materials such as textbooks purchased from one of the large education publishers. Aside from the students, teachers are most affected by a curriculum purchased by the school district. However, teachers typically are not involved in the purchase of curriculum materials, which is illogical as the use of these materials guides teachers’ classroom practices because they are so closely connected to the work teachers do every day (Beyer & Davis, 2009).

Included with off-the-shelf publisher curriculum packages are teacher's manuals (which from my observations, often are left unread), student books and possibly some software for the students to practice the content. Presentations aligned with the units are rarely included. While teachers may reference instruction manuals before specific lessons, reading each manual and digesting all the material is not a reasonable request given the time constraints of the job and expectations to teach multiple new lessons each day. Moreover, in past years, teachers gained expertise and familiarity with the manuals because they were exposed to them over time; today, teachers are not staying in the field and those who do stay are often shifted from grade to grade, never fully absorbing the content they teach (Carver-Thomas & Darling-Hammond, 2017).

The curriculum materials teachers encounter early in their careers can leave a powerful imprint for their future classroom practice. New teachers need support and some sort of guide to follow when they begin teaching. In colloquial terms, one must know where the boundaries of the box are before they can think outside of it. As teachers hone their craft, the relationship with the curriculum materials will most likely evolve. Understanding how teachers interact with and adapt the materials is important, especially because those outside education, such as policy makers or education reformers often use these materials to influence instruction (Brown, 2009). Teachers must have agency to make informed decisions about how to enact instruction in their classrooms and curriculum materials can serve as a critical tool for that decision-making work (Carlson, Davis, & Buxton, 2014).

Educative Curriculum Materials

Curriculum materials such as textbooks are ubiquitous in schools, but researchers have begun to investigate how curriculum materials could be designed to strengthen teacher learning on a wide scale because they might offer ongoing support that is intimately connected with practice (Collopy, 2003). "Curriculum materials for Grades K–12 that are intended to promote teacher learning in addition to student learning have come to be called *educative curriculum materials"* (Davis & Krajcik, 2005, p. 3). Educative curriculum materials are intended to help both experienced and novice teachers learn how to engage in productive curricular planning (Beyer & Davis, 2009; Davis, Beyer, Forbes, & Stevens, 2011).

Davis and Krajcik (2005) assert:

> Educative curriculum materials should help to increase teachers' knowledge in specific instances of instructional decision making but also help them develop more general knowledge that they can apply flexibly in new situations. Such a focus distinguishes educative curriculum materials from typical teachers' guides, which include supports for teaching strategies but not for teacher learning, and from typical K-12 curriculum materials more generally, which aim mainly at promoting student learning (p. 3).

I argue this distinction is incorrect in many cases. Teacher's manuals are educative curriculum materials; however, it is the way the teachers are reading them that distinguishes them as either simply a guide or a true educative curriculum material. Teacher's manuals can certainly increase teacher's knowledge, but if the reader skims the material instead of noting all the tips and tricks that are included and reflecting deeply on how the information can be applied to their own pedagogical practice, the manual would indeed fail to provide the teacher with knowledge that can be applied in new situations.

National, State, and Local Contexts

The issue of teacher preparedness for and readiness to implement effective educative curriculum is part of a far larger issue. Education in general is approaching crisis mode when it comes to finding competent, capable teachers, and in the U.S., K-12 classes are often staffed with long term substitutes or brand-new teachers (Arizona Department of Education, 2015). While schools are forced to hire teachers that are not adequately prepared to teach, the alternative solutions are not much better: schools can increase class sizes, cancel classes, or assign teachers from other fields to fill vacancies. Each of these solutions undermines the quality of education (Sutcher, Darling-Hammond, & Carver-Thomas, 2016). Research indicates that it takes from three to five years for a teacher to become effective in their instruction (Berliner, 2004). If educators continue to leave the profession before they have mastered the skills of effective teaching, it creates an unstable educational environment for students. Inexperienced teachers negatively impact student achievement (Sutcher et al., 2016). In addition to the impact on student achievement, this “revolving door” effect influences the climate and culture of the school and has financial implications since districts and charters must perpetually provide intensive professional development and on-going support to new educators (Sutcher et al., 2016).

Arizona, the state in which I work, continues to rank among the worst states for education. Aside from the lack of funding, there is a significant shortage of teachers. The Arizona School Personnel Administrators Association (ASPAA) conducted a survey in

2015-2016 school year of 130 school districts and charter schools. They found that of the 8191 open teaching positions, 2041 positions were still vacant, and 1831 positions were filled by teachers who did not meet standard requirements approximately one month into the school year. Vacancies were filled by teachers who were pending certification, had an intern certificate, or had an emergency teaching certificate. This data is in line with a previous survey conducted in November of the 2013-2014 school year, where 62% of the districts who responded to the survey reported having open teaching positions within their schools. Substitute teachers filled 938 open teaching positions, which was a 29% increase from the previous school year (Arizona Department of Education, 2015).

Teachers leave the profession for a variety of reasons. Podolsky, Kini, Bishop, and Darling-Hammond (2016), found that inadequate preparation, lack of support, challenging working conditions, compensation and personal reasons were the top causes of turnover. To slow what they termed the “exodus” of teachers from the profession, they suggested that improvements be made in teacher preparation, working conditions, compensation, hiring practices and teacher induction. These suggestions are not new and unfortunately, unlikely to occur. While most of these options require action at the policy making level, improving teacher support is something school districts can address. Teachers have too many responsibilities. If one or two things can be removed from their plate, they will feel more supported. Lesson planning takes an incredible amount of time and if teachers were simply given materials to use as a starting point for their lessons instead of being asked to create them from scratch, this simple solution may reduce one of the biggest burdens that teachers face.

When I began investigating the problem of practice described above, I was a general education teacher working at a Title I public elementary school located in central Phoenix that serves students in grades kindergarten through six. The school had approximately 631 students and 28 teachers. Over 80% of students were eligible for free or reduced lunch and most of the students (n=452; 72%) were Hispanic. The school received a letter grade of "C" from the state. This means it was considered a "Focus School" with an achievement gap between the bottom and top quarter of students, and, there was no growth in the bottom quartile passing rate. I taught second grade and had one classroom of students that I kept all day and taught all content areas, including math, which is of particular relevance to this study. The school used the Engage NY math curriculum, which was a new math curriculum aligned to the common-core. The curriculum was one of the first standards aligned open educational resources and was created through a partnership between the state of New York and the nonprofit Great Minds (creator of Eureka Math) and funded through New York state's $700 million federal Race to the Top award in 2010 (Heitin, 2016; Kaufman, Davis II, Wang, Thompson, Pane, Pfrommer, & Harris, 2017).

I provide this information on my former school, although I am no longer working there, as it is one of the settings for this dissertation study. In the summer of 2016, I accepted a position at a charter school in Scottsdale, Arizona. At the time of this study, my position was a fourth-grade math Subject Expert Teacher which means that I was responsible for teaching math to all the 4th grade students. The school used the Saxon math curriculum which is a teaching method for incremental learning or "spiral" learning of mathematics. The curriculum teaches a new concept daily in small, quick lessons and includes review of previous concepts learned through daily practice. New concepts are developed, reviewed, and practiced cumulatively rather than in discrete chapters or units (U.S. Department of Education, 2013).

In addition to math class, 4th grade students attend English, history, Mandarin, and physical education classes daily, each with teachers that focus solely in that content area. In addition, students have one "specials" class a day: either drama, music, art or engineering. The school delivers curriculum in a traditional environment, with students sitting at individual desks that face the board. They listen as the teacher presents the material, take notes and complete practice assignments independently. Students are tested weekly in the core subjects of math, history, and English.

While the two schooling environments in which I have worked are distinguished from one another by student bodies that are different economically and culturally, they do have a few things in common. In both situations, the teachers need support just as the students do and, in both schools, the administration welcomes teachers that are new to the profession and honing their craft. Based on my personal observations as well as data collected in past cycles of research for this project, teachers in both school settings are asking for help to improve their classroom practices, especially with how they present and deliver the curriculum to students. Research confirms that my observations in these two schools are consistent with teachers' experiences in other contexts; teachers across the United States are struggling with content presentation, especially when they are new to the subject area or grade (Sutcher et al., 2016). Teacher inexperience negatively impacts student learning, regardless of the rating of the school or the students who attend.

For this dissertation research project, I sought to work with teachers in kindergarten through third grades to determine if they found value in the use of pre-made digital math presentations. I chose to work with my former school district as they use the Engage NY math curriculum and my current school does not. If I were to pursue this line of inquiry at my current school, I would have needed to considerably modify the innovation I already had underway and create new presentations as that school uses Saxon Math as its math curriculum. I determined that it would be more effective to examine teachers' perceptions of digital presentations using the presentations I had already created and believed to be helpful to teachers, as is evidenced in the feedback I received on *Teachers Pay Teachers*. I determined that if this study indicated that teachers found these presentations beneficial, I would consider creating presentations for my current setting.

Theoretical Framework

Pedagogical Content Knowledge (PCK)

This study is primarily focused on how educative curricular materials can improve a teacher's knowledge base and ability to succeed in the classroom. I am particularly interested in teachers' Pedagogical Content Knowledge (PCK). I discuss PCK in more detail in Chapter Two, but briefly, it refers to a teacher's understanding of how to help students understand specific subject matter. It is the combination of a teacher's pedagogical knowledge (or how students learn, teaching approaches, methods of assessment, and knowledge of different theories about learning) and content knowledge (knowledge of the subject matter). Originally proposed by Lee Shulman in 1986, Pedagogical Content Knowledge (PCK) "…blends content and pedagogy into an understanding of how particular aspects of subject matter are organized, adapted, and represented for instruction” (Magnusson, Krajcik, & Borko, 1999, p. 96). Educative curriculum materials, by aiding teacher learning, can transform teacher’s knowledge simply from being either content specific or pedagogically centered to a combination that allows deep learning for both the student and the teacher.

In recent years, Shulman’s pedagogical content knowledge (PCK) model has been expanded by researchers to include a technological component, Technological Content Knowledge (TCK). At the intersection of Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK) lies the TPACK (Technological, Pedagogical and Content Knowledge) framework. Mishra and Koehler (2008), assert that the TPACK framework offers an innovative interpretation of how technology, content, and pedagogy work together as a separate type of knowledge to improve student’s learning. “Each component of TPACK is intrinsically linked to the other by purpose of concept development through the use of technology” (Bos, 2011, p. 10). The PowerPoint presentations that are the focus of this study are designed to offer teachers a user-friendly technological tool to simultaneously assist them with incorporating technology into their lessons and improve their pedagogical content knowledge.

Purpose and Significance of Study

A teacher’s knowledge base entails subject-matter knowledge, pedagogical content knowledge, and pedagogical knowledge. Educative curriculum materials (i.e., curriculum materials that include supports for teacher learning) can help teachers acquire new ideas in these different knowledge domains and they can help develop teachers’ content knowledge for teaching (Davis et al., 2014). This study focuses on the potential impact of one type of educative curriculum material: PowerPoint presentations prepared by a third-party expert teacher, which may fill the gap between simple presentation of content and a teacher truly understanding what students are supposed to learn as well as how they should learn themselves. Translating teacher's manuals to digital presentations for easy digestion and delivery will benefit new and experienced teachers in different ways. They will allow less experienced teachers to transition into their new roles while ensuring the required content is being delivered and experienced teachers can refer to the presentations as needed and use them as a pacing guide.

This research study attempts to establish how teachers describe the impact of adding a digital presentation component to their lessons. It seeks to determine if teachers find value in PowerPoint presentations, prepared by an expert teacher, to teach daily Engage NY math lessons and to obtain teacher's perceptions of utilizing digital presentations as an educative curriculum material to supplement and/or replace the use of teacher's manuals in their instruction.

Research Questions

The following research questions are examined in this study:

1. How do teachers describe the impact that pre-made digital slide share presentations (i.e., PowerPoint presentations) have on lesson planning, preparation, and pacing?
2. What impact does translating teacher's manuals into digital slide share presentations (i.e., PowerPoint presentations) have on teacher's pedagogical content knowledge?

Summary

Based on my observations and experiences, even though a teacher may be considered a subject matter expert and demonstrate a deep understanding of the content area they teach, it does not guarantee that their students will learn. The ability to foster understanding of the subject for the students is crucial to a teacher's success (Magnusson et al., 1999; Davis & Krajcik, 2005; Park & Oliver, 2008; Krajcik & Delen, 2017). New teachers are especially susceptible to these types of difficulties in the classroom as they are learning to navigate their new position and are balancing classroom management with subject dispersion. Most teachers are not subject matter experts, nor are they pedagogical experts; they are trying to balance the two and improve in both aspects of teaching.

To improve their content knowledge, teachers need to complete additional research outside of their school day. Teacher's manuals often contain information that has been carefully researched and considered if not previously implemented in classroom settings. If teachers were able to read the manuals for each lesson, each day for every subject, they may very well have the information they need. Unfortunately, based on my observations, teacher preparation programs do not teach this very important skill and the time a teacher can devote to new learning is typically minimal at best. To assist teachers in delivering content and to confirm that the content is presented with some sort of fidelity, an easy solution would be to create slideware resources, such as PowerPoint presentations, that allow the teacher to have talking points and be sure that all the content is at least available. Teacher's manuals are an overlooked resource that will fail to be used in their entirety until they are made more easily accessible. This study seeks to determine if translating teacher's manuals into digital presentations will improve the lesson planning, preparation, and pacing of content as well as the teacher's pedagogical content knowledge.

Organization of the Dissertation

The following chapters in this dissertation describe the mixed methods action research project that was designed to examine the impact digital presentations have on teacher's pedagogical content knowledge. Chapter 2 introduces the theoretical framework of Pedagogical Content Knowledge and provides a review of current literature to support the study. In Chapter 3, the methodology, including the setting and participants, innovation, instruments, and the data analysis used in the study is described. Chapter 4 will present the findings and those findings will be reviewed and discussed in Chapter 5.

Chapter 2

Literature Review and Theoretical Framework

The previous chapter discussed my personal experiences relating to curriculum and curriculum materials and introduced the need for teacher's manuals to be translated into digital presentations, allowing teachers to easily access their information. This chapter includes a review of existing literature that informs this study as well as discussion of the theoretical framework that influences the direction this action research study will pursue.

The first section explores the current understanding of curriculum in education, discusses the use of curriculum materials, paying attention to how curricular materials are used by new teachers. I highlight textbooks and teacher's manuals as examples of commonly used curriculum materials. Then, I define the concept of *educative* curriculum materials and summarize studies that have addressed how educative curriculum materials can improve teachers' learning and instruction. I make the case for digital presentations as an overlooked educative material that can aid teachers' learning by translating manuals into easily accessible bits of information.

Finally, the main theoretical framework guiding the study, Pedagogical Content Knowledge (PCK) is defined and explored to determine its relationship to teaching and teacher learning. As this study seeks to determine how teachers describe the value, they see in digital presentations translated for use as an educative curriculum material, digital presentations are discussed as an alternative to simply reading the teacher's manuals. To close, I propose that translating the educative materials already present in teacher's manuals may help teachers improve their pedagogical content knowledge.

Curriculum

The term “curriculum” is commonplace in educational language in North America, but…its usage is “inconsistent and multifarious” (Fraser & Bosanquet, 2006, p. 269) as the term curriculum is not used universally throughout the world. “Some countries use pedagogy, others didactik, others have no counterpart to curriculum, and still others such as China appear to be borrowing North American curriculum terms…” (Connelly & Xu, 2010, p. 325). Sherin and Drake (2009) offer three meanings of the term curriculum common in the U.S.:

1. The set of written materials provided to teachers—the textbook, teacher’s guide, assessment materials, etc.
2. The lesson that is enacted in the classroom.
3. The form of district- or state-level learning objectives for students (p. 468)

The definition of curriculum has long been contentious as it is closely linked to philosophical, conceptual, and ideological views on the purpose of education (Connelly & Xu, 2010). While some view curriculum primarily in terms of structure, as Sherin and Drake’s (2009) definitions one and three above suggest, others argue it is more alive and malleable, more aligned with definition two. Grossman and Thompson (2008) assert that "a curriculum is more for teachers than it is for pupils. If it cannot change, move, perturb, inform teachers, it will have no effect on those whom they teach” (p. 2014).

Shulman (1990) argues that curriculum and teaching have long been treated as opposites, akin to hot and cold. He stresses that while curriculum might be the backdrop for teaching, the two are not to be confused. Though often planned, teaching is typically adaptive, interactive, spontaneous, and reactive while curriculum, in the form of written materials, and units of instruction, is the carefully planned organization of the subject matter (Ben-Peretz, 2011). Regardless of its exact definition, the term curriculum is ultimately linked to formal education and schooling, especially in the United States where the curriculum dictates the content of a class. As Sherin and Drake's (2009) multiple meanings of curriculum suggest, the creation and implementation of a curriculum may not be the sole jurisdiction of teachers, although they can have some influence. While teachers must present the curriculum they are given by their district, how they present is often left entirely up to them.

Curriculum Materials

Curriculum materials are the representational tools that teachers use to guide their teaching practice and curricular goals regarding what is to be taught (Carlson et al., 2014). The materials provide support and guidance on structure and flow for specific content, recommended instructional strategies, and suggested experiences for the learners. These materials can take a wide variety of forms including: curriculum frameworks or state standards (i.e., what students should be learning); curricular programs; textbooks; teacher-created materials, and other resources, such as professional publications that focus on curriculum and instruction, lesson plans, teacher guides, student worksheets, and other representations of both content and pedagogy (Brown, 2009; Grossman & Thompson, 2008; Remillard, 2005).

Classroom teachers tend to rely on a variety of curriculum materials as sources for their lesson planning; the most commonplace materials are items such as teacher's manuals, textbooks and/or workbooks in printed form (Ben-Peretz, 2011; Davis et al., 2014). Although their most recognizable format may be a textbook, curriculum materials can be almost anything as they are simply an "…embodiment of the planned curriculum, physical artifacts and tools that represent its constituent goals, instructional approaches, student activities, and measurable outcomes" (Biggers, Forbes, & Zangori, 2013, p. 52).

These resources often play an important role in shaping classroom activities and serve as crucial tools for teachers (Biggers, Forbes, & Zangori, 2013). Unlike higher level frameworks and objectives, curriculum materials are resources connected to teachers' daily work and often used to help them make decisions about classroom practices and guide instruction (Ball & Cohen, 1996; Beyer & Davis, 2009; Davis, Sullivan-Palincsar, Smith, Arias, & Kademian, 2017). The materials are intimately connected to the enactment of instruction and "…offer ongoing support for pedagogy and subject-matter content throughout an entire school year" (Collopy, 2003, p. 288). Effective curriculum materials are coherent, rigorous, and focused on big ideas. These materials help guide the lesson sequence and allow the content to unfold logically, with ideas building on one another toward the development of an integrated understanding and support for students to see the coherence (Roseman, Linn, & Koppal, 2008).

Curriculum materials vary and fall along a continuum ranging from specifying exactly what should be taught, to offering ideas about what and how to teach (Grossman & Thompson, 2008). This variation can leave many decisions up to the individual teacher and can affect how teachers interpret the material. If the materials are too prescriptive, they risk ignoring or dismissing teachers' autonomy and may make the curriculum materials less effective (Davis & Krajcik, 2005) while if they are too vague, the teacher may not provide the intended information to the students. Incorrect interpretation can have a negative affect and may diminish the opportunities teachers have to learn through curriculum materials (Collopy, 2003).

Curriculum materials design. The design of curriculum materials influences classroom instruction; well-designed curriculum materials can and do support changes in teachers' thinking and practices (Remillard, 2000). Unfortunately, curriculum materials have largely been designed to speak *through* teachers rather than directly *to* them (Remillard, 2005) even though best practice indicates that the curriculum development process include explicit attention to student thinking and ties to teacher practice (Carlson et al., 2014). The materials should be "…designed to place teachers in the center of curriculum construction and make teachers' learning central to efforts to improve education, without requiring heroic assumptions about each teacher's capacities as an original designer of curriculum" (Ball & Cohen, 1996, p. 7).

Remillard (1999; 2000) investigated how redesigned curriculum materials might support curricular and pedagogical change in mathematics education. Through analyzing two fourth-grade teachers' learning during their first year of using a new mathematics textbook, the author found that curriculum is directly affected by how it is enacted. She observed that curriculum materials have a unique potential to influence teacher's professional practice and that while texts might contribute to change in teaching, they do not affect change by simply providing teachers with activities for students. Teachers play an incredibly important role in enacting the curriculum and that enactment is dependent on how the teachers read and interpret the text.

Currently, more effort is being concentrated on supporting teachers as they enact the curriculum material. Instructional leaders and curriculum material designers are considering “…teachers’ capacity to enact curriculum materials—to read, understand, and adapt available curriculum materials to meet the specific needs of the students in their classroom while remaining faithful to the materials’ intended outcomes” (Land, Tyminski, & Drake, 2015, p. 154). The focus for curriculum designers is changing. Instead of viewing the curriculum as something just for students and the teacher's guide as merely an instruction manual for teachers, both ought to be considered as terrain for teachers' ongoing learning (Ball & Cohen, 1996). Designing content must create materials that are clear, easy to use, and engaging for both the teachers and their students.

While the design of curriculum materials and the materials themselves can influence classroom practice, “…the enacted curriculum, or the way in which the planned curriculum is implemented in classroom settings, is rarely a direct reflection of classroom practices instantiated in curriculum materials” (Biggers, Forbes & Zangori, 2013, p. 52). Together, a teacher’s knowledge and beliefs about teaching and learning, plus the characteristics of curriculum materials (i.e., how they represent content), shape how teachers use curriculum materials (Davis et al., 2017). Teachers’ practices are formed as they use curriculum materials in ways that address their own unique characteristics, needs, and goals (Beyer & Davis, 2009) but ultimately, it is teachers “…who will interpret the information the authors offer in the curriculum materials and make decisions about whether and how to implement curricular tasks in their classroom” (Stylianides, 2007, pp. 210-211). Curriculum materials should not be considered a cure-all for struggling teachers, or any teacher. Teachers should have the ability to make decisions that directly affect the students in their classrooms, but curriculum materials can serve as a critical tool for that decision-making (Carlson et al., 2014).

Textbooks. Textbooks, defined by Remillard (2000) as "curriculum programs sold by commercial publishing companies that include student texts and a teacher's guide" (p. 344), are a common curriculum material already available and in use in many schools. Most textbooks come with a teacher's manual and various other resources for the teacher to utilize during presentation of the content.

Teachers and teacher educators have had an ambivalent relationship with textbooks even though the official inclusion of textbooks in the classroom has been almost universal in American schools throughout history (Grossman & Thompson, 2008). While in the past textbooks were used as the primary curriculum material for most subjects, their use has dwindled in many schools. Ball and Cohen (1996) explain their declining popularity as a function of shifting values within the teaching profession, away from acceptance of standardized universal materials and towards an "idealization of professional autonomy [that] leads to the view that good teachers do not follow textbooks, but instead make their own curriculum" (Ball & Cohen, 1996, p. 6). In other words, many teacher educators adhere to the idea that curriculum materials should be created by individual teachers, based on their personal expertise and experiences. Therefore, textbooks are often judged to be ineffective materials and left unused in the classroom by teachers and students.

Even though teachers may feel that textbooks have weaknesses, those textbooks could serve as a scaffold for novice teachers to help them 'learn to think pedagogically about content' as they lack the knowledge and experience needed to develop their own curriculum (Ball & Feiman-Nemser, 1988; Grossman & Thompson, 2008, p. 2015). Research shows that beginning teachers spend a lot of time looking for curriculum materials that will help them understand what they should teach (Davis et al., 2011; Grossman & Thompson, 2008). New teachers simply do not have the experience to imagine how a lesson would play out in a classroom environment and they lack the frameworks that would allow them to organize new ideas about their teaching (Davis & Krajcik, 2005). The use of pre-developed curriculum materials such as textbooks can provide new teachers with tools for instruction that have already proven to be successful for other teachers and does not force them "…to reinvent the wheel each time they teach something new" (Grossman & Thompson, 2008, p. 2014).

Curriculum materials and professional development. Although novice teachers are particularly likely to seek out curriculum materials to prepare for their work, teachers at all career stages can benefit from new tools that promote their own understanding. Research shows that when teachers expand their knowledge, it in turn improves their practice in the classroom and positively impacts student learning (Davis et al., 2014, 2014). Teacher learning can occur in many settings: on the job, during collaboration with other teachers, through mentoring, and in professional development. The curriculum materials teachers use in their classrooms do not necessarily contribute to teacher learning and professional development by themselves, but, as discussed in the next section, they can create teacher learning if designed correctly. How teachers use the curriculum materials ultimately determines how teachers learn from them and thereby, their effectiveness.

Educative Curriculum Materials

Traditionally, the design of curricular materials was primarily focused on supporting student learning. Recently, scholars have begun to recognize that these materials can serve teachers as well as students; curricular materials can provide potential learning opportunities for the adults who teach them (Ball & Cohen, 1996; Collopy, 2003; Davis & Krajcik, 2005). In 1996, Ball and Cohen proposed reconceptualizing the creation of curricula to help teachers more explicitly implement its content in practice. Ball and Cohen (1996), asserted that if curriculum designers reconsidered the prescribed limits and boundaries of the curriculum materials, the materials themselves could offer teachers opportunities to learn from their work and be more rather than less informed. Educative curriculum materials have the "…potential to provide sustained, scalable, job-embedded, discipline-specific, professional learning opportunities that teachers need" (Davis et al., 2017, p. 295).

Educative curriculum materials are curriculum materials for Grades K- 12 intended to promote teacher learning by developing a stronger knowledge base, which scholars hypothesize will then impact student learning (Ball & Cohen, 1996; Davis & Krajcik, 2005; Beyer & Davis, 2009; Davis et al., 2011; Carlson et al., 2014; Krajcik & Delen, 2017; Land et al., 2015). The intent of educative curriculum materials is to improve instruction through better content presentation, and to support teacher learning. Educative curriculum materials are differentiated from other types of curricular materials by their explicit focus on teacher learning. They include specific information that explains to teachers the underlying rationales and choices of those who developed the materials. They also provide suggestions on how teachers might address common implementation issues, as well as how to adapt the materials for different students and contexts (Cervetti, Kulikowich & Brave, 2015; Schneider, Krajcik, & Marx, 1999). "Educative features" refer to these elements in curriculum materials specifically intended to provide support for teacher learning (Davis et al., 2017). Educative curriculum materials can support teacher learning in non-subject specific ways as well, through their organization and depiction of pedagogy, which is especially beneficial for teachers who have minimal classroom experience (Land et al., 2015).

As classrooms have become much more diverse and students want to learn in meaningful ways that make sense to them, understanding how to design educative curriculum materials is critical to facilitating teacher learning of unfamiliar and challenging instructional practices (Collopy, 2003; Krajcik & Delen, 2017). Educative curriculum features can help teachers add new ideas, both specific and general, to their repertoires, learn how to anticipate and interpret what learners may think about or do in response to instructional activities and serve as cognitive tools to help teachers make connections between general principles and specific instructional moves (Davis & Krajcik, 2005; Davis et al., 2014).

The design of educative curriculum materials is extremely important as well-designed materials can affect both teacher and student learning. While designing materials that add to teacher's repertoires seems straightforward, it is very difficult to design materials that help teachers learn to connect ideas and learn content as they teach (Davis & Krajcik, 2005). Educative curriculum materials offer a cyclical learning process for teachers. As teachers use the educative materials, they can plan lessons more productively and improve their pedagogical practice. As teachers continue to interact with the materials, the educative supports embedded in the materials help the teacher make more informed decisions about the content they are presenting and can introduce or reinforce the pedagogical processes that will most positively affect their teaching (Beyer & Davis, 2009).

Teacher's Manuals. Teacher's manuals are an example of educative curriculum materials that are readily available and often overlooked because they are cumbersome to use and difficult to digest. Teaching manuals (also called teacher's editions or teacher's guides) assist teachers in navigating through lessons that have been created by an educational publisher, a district curriculum designer or another teacher. Most teachers are given teacher's manuals for each content area they will teach once assigned to a grade level. Teacher's manuals often have many educative features and can help teachers "…learn how to listen to and interpret what students say, and to anticipate what learners may think about or do in response to instructional activities" (Ball & Cohen, 1996, p. 7). Teacher's guides can help scaffold teachers' learning by demonstrating what students should be doing and learning at any given point as well as provide descriptions of classroom interactions which help teachers develop a better understanding of how students learn (Ball & Feiman-Nemser, 1988; Remillard, 2000).

Although teacher's manuals may have the educative features that teachers need, for reasons that are unclear, teachers often do not utilize them appropriately, or at all (Miller & Paget, 2016). Ideally, teachers should incorporate the educative features in the teaching manual to emphasize instructional features as well as the theoretical intentions of the designers (Neuman, Pinkham, & Kaefer, 2015). Teachers may not use the teachers guides because the guides tend to be large and dense; they can be awkward, difficult to navigate, and time consuming to use (Miller & Paget, 2016). While many teachers do not read the manuals at all, others may skim or only read for key points. Even then, what the teachers understand from the content is dependent on how they interpret the text. In her study, Collopy (2003), found the two teacher's interpretations of the content illustrate this point:

> Both reported reading the materials thoroughly. However, one teacher expected curriculum materials to support her own learning about what and how to teach and reported that the guidance in the teachers' notes was particularly helpful. She also used the dialogue boxes to learn about how students might communicate their mathematical idea…in contrast, the other teacher saw the teacher's notes and other content for teachers as not relevant for an experienced teacher who was comfortable with her knowledge of mathematics (p. 307).

Land et al. (2015) investigated the range of pre-service teachers' approaches to reading educative curriculum materials. They analyzed participant's reading of five lessons to determine which features they noticed, or thought were important when reading curriculum materials. The assumption, that participants would read educative curriculum materials in an educative manner, turned out to be false. In fact, the authors found that participants did not read educative features in educative ways. They concluded that initial readers of curriculum materials will not always notice the educative features of a lesson plan and learn something from them.

How teachers use curriculum material is determined by how they interpret the curriculum and how teachers interpret the curriculum depends on how they read and understand it. If teachers are not reading curriculum materials effectively, there is little chance they will evaluate and adapt them (Land et al., 2015). To provide teachers with an alternative option to present subject material, teacher's manuals should be translated into digital presentations. This will allow the content to be "read" more consistently by teachers and therefore, enacted as designed, with increased fidelity.

Digital Slide Presentations as Educative Curriculum Materials (ECMs). There has been a change in the media used to communicate in educational settings from 'chalk and-talk' and occasional flip-charts to overhead transparencies and to PowerPoint slides (Craig & Amernic, 2006). Although not developed for teaching and learning purposes, PowerPoint's flexibility, visual attractiveness, and the immense potential of its features has rendered it a favorite with all level education professionals around the world (Konstantinidis, Theodosiadou, Papachatzi, & Pappos, 2017). The diverse media options that PowerPoint encompasses supports a range of learning styles (Adams, 2006; Miller & Paget, 2016).

Levasseur and Kanan Sawyer (2006) found that effective use of PowerPoint (including employing more relevant images with narration and less text) can result in increased learner satisfaction. In other studies, teachers reported that a basic slide deck provides a vision of the pathway through the curriculum (Miller & Paget, 2016). As these digital slide share presentations (ex: PowerPoint, Prezi, SMARTboard, ActivInspire) are designed with teacher learning in mind, they meet the definition of educative curriculum materials proposed by Davis and Krajcik (2005). Presentations can change the way teachers interact with the material by providing lesson structure, pacing, cues, and insights. PowerPoint is a simple tool that can easily be used to support educators in creating and/or delivering content, as well as to evaluate student learning (Miller & Paget, 2016). If teachers are less consumed with creating content, they will have more time to evaluate what they are presenting and ensure the curriculum student mastery and achievement (Snider & Gershner, 1999).

ECMs and content. Studies have shown that curriculum materials can be used to help both teachers and students learn. “The field of research on teachers’ use of curriculum materials emerged during the last quarter of the 20th century and has grown tremendously…” (Charalambous & Hill, 2012, pp. 447-448). Research around teachers' use of educative curriculum materials spans multiple content areas, including science, math, and English language arts (e.g. Collopy, 2003; Cervetti et al., 2015; Charalambous & Hill, 2012; Grossman & Thompson, 2008; Land et al., 2015; Noh & Webb, 2015).

ECMs and science. Davis et al. (2017) designed educative features to enhance commercial science kits that elementary teachers were already using in their classrooms. The authors sought to determine how teachers use and adapt materials. They were able to detect the influence of specific educative features on teacher enactment using “tracers”, or specific pieces of information they had enhanced, and then coded the teacher enactment of those tracers. They found that teachers adapt the curriculum materials as they enact them and factors that affect the changes teachers make are time, strengths, and weaknesses of the materials and the teacher’s own understanding of the content.

ECMs and math. Remillard (1999, 2000) was one of the first contributors to the field of ECM research. She recognized that teachers ultimately determine which curriculum materials are enacted and examined the relationship between teacher learning and pedagogical change. Using case study methods, Remillard questioned if the textbook itself would be able to affect teacher learning. Studying two fourth grade math teacher’s use of a mathematics textbook, she found that materials that foster teacher learning must engage teachers in the process; specifically, she determined that well designed materials can support change in teacher's practices, but only if they interpret the text in a similar manner. In her observations, she found that teachers read the text differently and therefore did not develop the same understanding of the materials. She recommended that curriculum materials include features such as call outs, sample dialog, and explicit explanation of the designer's intentions for the content.

Charalambos and Hill (2012) presented multiple case studies which examined the relationship between teacher knowledge and curriculum materials. The authors explored how curriculum materials contributed to the quality of math instruction. Charalambous, Hill, and Mitchell (2012), evaluated the mathematical quality of three teacher's lessons on integer subtraction and found that educative curriculum materials can help teachers with "…low mathematical knowledge for teaching (MKT) provide adequate instruction…" (p. 489). The authors also found that in some cases curriculum materials can offset teachers' limitations and help low-MKT teachers improve their instruction.

Introduced by Ball, Thames and Phelps in 2008, the MKT model includes various elements that are necessary for teaching mathematics, such as understanding how and why algorithms work, analyzing student errors, and knowing how to define mathematical concepts in student friendly language. MKT is theory for teaching built on Shulman's (1986) notion of pedagogical content knowledge which suggests that teachers who do not know a subject well are not likely to help students learn the content; however, just knowing a subject well may not be enough for teaching (Ball, Thames, & Phelps, 2008). The most effective teachers combine their subject knowledge with the pedagogical knowledge, creating a new type of knowledge, pedagogical content knowledge. The framework of pedagogical content knowledge shapes this study and is described in detail in the next section.

Theoretical Framework

Pedagogical Content Knowledge (PCK)

Research shows that teachers' responses to curriculum materials, including how they use materials, and what they learn from them, are strongly shaped by a combination of their subject matter knowledge, their pedagogy, their beliefs about students and teaching (Ball & Cohen, 1996; Collopy, 2003; Grossman & Thompson, 2008; Stylianides, 2007). Pedagogical Content Knowledge (PCK) is a widely recognized framework for understanding teacher practice. According to this perspective, teachers have a kind of knowledge that is unique to their profession: pedagogical content knowledge. This knowledge is different than content knowledge or knowledge of pedagogy because it refers to a teacher's understanding of how to help students learn specific subject matter (Magnusson et al., 1999). Knowing what to teach is important. Even more essential is knowing how to teach content so that students understand the subject matter. "PCK is an acknowledgement to the importance of the transformation of subject matter knowledge per se into subject matter knowledge for teaching" (Park & Oliver, 2008, p. 262).

Originally proposed by Lee Shulman in 1986, PCK represents the blending of content knowledge of the subject matter (mathematics, science, etc.) and pedagogy (how students learn – including things like teaching approaches or knowledge of different learning theories) into an understanding of how particular aspects of subject matter are organized, adapted, and represented for instruction to meet the diverse interests and abilities of learners (Bullough, 2001; Cochran, King, & DeRuiter, 1991; Magnusson et al., 1999). Essentially, Shulman was searching for improved theoretical understanding that better described how teachers adapt the curriculum they teach and to understand how teachers teach.

To be successful, teachers need strong subject matter knowledge, pedagogical knowledge (PCK), and knowledge of curriculum (Davis & Krajcik, 2005; Krajcik & Delen, 2017; Magnusson et al., 1999). Pedagogical knowledge includes "…the knowledge teachers have about the vertical curriculum in their subject(s); that is, what students have learned in previous years and what they are expected to learn in later years" (Magnusson et al., 1999, p. 103). A key mechanism to improve teachers' PCK is via educative curriculum materials. Research shows that educative curriculum materials can help teachers acquire new ideas in subject-matter knowledge, and pedagogical knowledge as well as develop teachers' content knowledge for teaching (Davis et al., 2014).

Technological Pedagogical Knowledge (TPACK)

Today good teaching requires that teachers have strong pedagogical content knowledge as well as an understanding of how digital technology might be incorporated into the classroom to support student learning. Effective teaching with technology involves combining strong pedagogical knowledge (PK) and content knowledge (CK) with an understanding of how to represent concepts utilizing the most appropriate technology (Mishra & Koehler, 2008). To incorporate technology use in education, Shulman's pedagogical content knowledge (PCK) model has been expanded by researchers to include technology knowledge (TK), (see Figure 1 below).

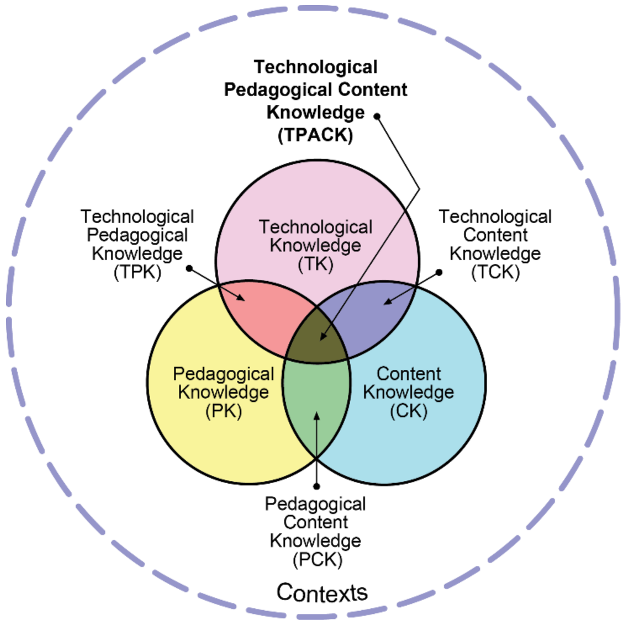

Figure 1. TPACK model reproduced by permission of the publisher, © 2012 by tpack.org

Koehler and Mishra (2009) characterize TK as understanding information technology well enough to relate it to everyday life and recognize when it can assist or impede the achievement of a goal. Pedagogical knowledge (PK) and technological knowledge (TK) intersect to form technological pedagogical knowledge (TPK), which is an understanding of how teaching and learning may change when technology use is implemented and includes determining how technological tools can promote or detract from learning objectives. The intersection of TK and CK forms technological content knowledge (TCK), which is an understanding of how technology and content influence and constrain one another. The junction of Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), and Technological Pedagogical Knowledge (TPK) houses the TPACK (Technological, Pedagogical and Content Knowledge) framework. TPACK seeks to identify the nature of knowledge required by teachers for technology integration in their teaching, while addressing the complex nature of teacher knowledge. The TPACK framework offers an innovative interpretation of how technology, content, and pedagogy work together as a separate type of knowledge to improve student's learning (Mishra & Koehler, 2008).

"With its use of technology as the medium of instruction rather than as an add-on, TPACK provides a theoretical foundation to transition from a causal relationship with technology to a more connected bond built on an understanding of appropriate pedagogy and content" (Bos, 2011, p. 17). The components of TPACK work together to increase student motivation and to make the content more accessible so that it meets the student's needs. TPACK is now one of the most widely recognized frameworks for technology integration and "the notion of TPACK is quickly becoming ubiquitous within the educational technology community, becoming popular among researchers and practitioners alike, as it attempts to describe the complex-relationship between and among the domains of content, pedagogy, and technology-related knowledge" (Archambault & Barnett, 2010, p. 1656).

TPACK has advanced significantly since it was introduced by Mishra and Koehler in 2006 and over time, the TPACK framework has encouraged teachers, researchers and teacher educators to move past treating technology as an "add-on" and instead focus on the connections that technology, content, and pedagogy demonstrate in classroom contexts. PowerPoint presentations give teachers an opportunity to utilize a well-known form of digital technology and through repeated daily interactions, teachers and students will become more familiar with and comfortable using a digital component in their lessons.

The International Society for Technology in Education

The use of technology in the classroom has been shown to increase student achievement and academic performance (ISTE, 2014), and one of the biggest supporters of technology use in the classroom is the International Society for Technology in Education (ISTE). ISTE is one of the largest non-profit organizations that advocate for the integration of technology in the classroom. It publishes the journal *Learning and Leading with Technology* and *Journal of Research on Computing in Education* and is known for promoting best practices regarding technology use. In June of 2017, the organization released ISTE Standards for Educators, which supports educators by providing a framework for learning, teaching, and leading that is amplified by technology.

The ISTE standards offer a guide for teachers, students, administrators, and coaches to inform their decisions regarding technology use. Those standards include the following titles: learner, leader, citizen, collaborator, designer, facilitator, and analyst. The current study addresses the collaboration standard as it specifies that educators "…dedicate time to collaborate with both colleagues and students to improve practice, discover and share resources and ideas, and solve problems" (ISTE, 2017). The introduction of PowerPoint presentations in the classroom allows teachers to utilize digital technology in a small way and provides support for content delivery which will allow teachers to focus on other aspects of their classroom and improve their practice.

Summary

Educative curriculum materials can improve teacher's pedagogical content knowledge by helping them evaluate student work, explain specific ideas, predict student misconceptions, and interpret teacher's guides and manuals (Collopy, 2003; Grossman & Thompson, 2008, Davis & Krajcik, 2009; Land et al., 2015). ECM's allow teachers to transform their knowledge simply from being either content specific or pedagogically centered into a combination that allows deep learning of both the student and the teacher. "Teachers with differentiated and integrated knowledge will have greater ability than those whose knowledge is limited and fragmented, to plan and enact lessons that help students develop deep and integrated understandings" (Magnusson et al., 1999, p. 95).

Conclusion

Although there has been a growing body of work that reveals the benefits of educative curriculum materials, there has been very little consistency in the literature indicating which materials can be described as "educative". As the only agreed upon definition seems to be that educative curriculum materials are simply materials that help teachers learn as they are teaching to students, the benefit of these materials can be and is often overlooked or misunderstood by teachers and administrators. Designers of educative content are not clearly explaining their purpose in the curriculum materials they are creating and selling to schools. Therefore, teachers continue to overlook the educative supports that are provided. Educational publishers and creators of any content need to ensure that the content is presented to teachers in an easily accessible format. To date there is no literature that informs whether digital slide share presentations (i.e. PowerPoint, Prezi, etc.) effectively serve as educative curriculum materials. The purpose of this study is to determine if teachers find value in receiving the content in a digital presentation format and if they feel use of the presentation improves their pedagogical content knowledge. If so, a case can be made for the use of digital slide share presentations such as PowerPoint as educative curriculum materials.

Chapter 3

Method

The previous chapter presented the theoretical framework and research-based support for the need for this study. This chapter provides information about the methodology used to conduct this action research study, including a description of the research design, setting and participants, instrumentation, intervention, data collection procedures, my role as a researcher, and the data analysis procedures including strategies used to analyze, interpret, and deconstruct the data.

Research Design

This study relied on a mixed-methods action research design. Action research is systematic inquiry conducted by researchers who have a direct interest in the process and outcome for their specific setting (Mertler, 2013). It is a research design in which the practitioner, who is also the researcher, systematically and scientifically investigates self-identified problems of practice to improve practice within their local context (Mertler, 2016). In action research, practitioners identify an area of focus, collect data, analyze and interpret that data, and then develop an action plan (Mills, 2013). Action research projects typically aim to find immediate answers to local-level problems of practice (Mertler, 2018).

Action research lends itself to educational settings as it narrows the gap between traditional research methods and unpredictable real-life experiences, allowing teachers to reflect on the effects of their teaching practices. It encourages change as it compels educators to think critically about, reflect on, and work to improve their own practice. With each cycle of investigation, new information about how educative curriculum materials affect teacher practice allowed me, as the researcher, to identify the strengths and weaknesses of digital presentations in the classroom.

While the practical action research design of this study is small in scale and offers a narrow focus on a specific problem, the findings may be relevant for other educators across multiple grade levels and subject areas. The intent is to determine how theory connects to practice and provide practical and relevant data that will improve educational practice (Creswell, 2015). However, action research is not simply problem solving; it seeks to create something new and discover creative solutions to education problems (Mertler, 2018).

Setting and Participants

Setting. The setting(s) for this study consisted of 13 public, private, and charter elementary schools located across the United States that use the Engage NY math curriculum. Originally, the study was to be conducted in a small public-school district in central Phoenix consisting of five elementary schools that serve students in grades kindergarten through six. When I began investigating my problem of practice, I worked as a general education teacher at one of the Title I elementary schools in the district and it was during this time that I initially became aware of teachers' struggles with presenting new content such as Engage NY math. Teachers in this district are responsible for teaching all core content including math, reading, social studies, and science. Students attend specials classes once a week that include physical education, music, art, and library. The teachers typically present the curriculum in a traditional manner, with students sitting at either a table with small groups, or individual desks that face the board, depending on their grade level and teacher's preference.

The district introduced teachers to the Engage NY math curriculum during my second year as a teacher. This new curriculum was unlike anything the teachers had previously used. Many teachers struggled to fully understand how the content should be presented and to maintain the required pacing of math lessons. Teachers read through the teacher's manuals and attempted to interpret the new curriculum but found the process to be very time consuming. Most teachers I spoke to told me they never had enough time to truly review and understand the content they were expected to present.

My assumption was that we would receive support and instruction for teaching the new curriculum on Wednesdays during our professional development meetings. Instead, the professional development sessions focused on evaluating students' test scores or introducing alternative curriculum options for all subject areas. Through conversations with my peers, I found that while teachers agreed that these topics were helpful for general knowledge, they did not feel that the content covered during professional development sessions addressed their most urgent classroom needs, including teaching this new math curriculum. This is what lead to my initial creation of the presentations. I was looking for a solution that would help myself and my teammates present this new math curriculum with fidelity and without being overwhelmed by the amount of new material. Once I used the presentations in my own classroom, I shared them with my teammates and finally, with other teachers on Teachers Pay Teachers.

Separately and coincidentally, during the spring of 2018, I discovered two Facebook groups that each offer guidance for teachers and by teachers who use the Engage NY math curriculum. The Facebook group members can post comments or questions and ask for help regarding problems they are having with the Engage NY math curriculum. After reading posts from several teachers over a period of a few weeks, it seemed that many of the teachers were struggling to keep up with the lesson pacing and structure as I did when I initially taught the curriculum. Therefore, I determined that teachers in these Facebook groups may be interested in participating in my study. I sought and gained permission to post information about my study to the group boards to recruit teachers who would be interested in participating in my study.

The setting(s) for this study therefore included both the school in central Phoenix where I previously taught, as well as twelve schools drawn from the Facebook groups. The school settings from the Facebook groups were comprised of varying types of schools that included public, charter, private, and tribal schools. The private and one of the tribal schools were both Catholic schools, while the public school districts ranged from low-income rural school districts through large city affluent school districts. Several were Title I schools and one was a magnet school.

Participants. The sampling strategy I used was purposive as I sought to find potential participants "…based on specific purposes associated with answering a research study's questions" (Teddlie & Yu, 2007, p. 77). My sample was selected from kindergarten, first, second or third grade teachers who use the Engage NY math curriculum and who volunteered to describe their experiences teaching Engage NY math content using digital presentations. The participants were willing to offer their opinions about whether the innovation was helpful and if using the presentations would improve their perceptions of their own PCK.

The initial participants included elementary school math teachers recruited from both the school settings in central Phoenix described in the previous section, and from schools represented by members of the two different Facebook groups: Engage NY/ Eureka Math Teacher Idea Group and Second Grade Eureka Math. Both Facebook groups are closed, meaning potential members must be approved by the administrator of the Facebook page before they can join. The Engage NY/Eureka Math Teacher Group website address is https://www.facebook.com/groups/254283485074352/. The group was created in July of 2017 and had over 2,500 members at the time of the study. The Second Grade Eureka Math group was created in May of 2018, has approximately 1,000 members, and can be found at the following web address: https://www.facebook.com/groups/1833083893659896/.

To recruit local participants, I first reached out via email in the spring of 2018 to principals at three schools in the Phoenix school district where I was previously employed to introduce the study and its purpose. Those leaders were asked to invite teachers to participate in the study and to connect me with them. Three teachers from my previous school district contacted me and all were invited to participate in the study. Subsequently, in the early part of the summer of 2018, I posted a detailed note introducing myself and explaining my study on both Engage NY Facebook group's walls. I asked participants to contact me via email or Facebook messenger if they were interested in participating. By the end of summer 2018, 41 total potential participants had contacted me: 3 from my previous district and 38 teachers from the Engage NY Facebook groups. I forwarded my pre-intervention survey via email to all 41 potential participants and received a total of 34 completed pre-intervention surveys in response; two responses were from teachers from my previous school district and 32 were from teachers who were recruited from the Engage NY Facebook groups.

Final Demographic Data

The initial survey contained verbiage informing participants that they would not be compensated for their participation in the study but may have benefited professionally from being provided educative curriculum materials and/or reflecting on the process. There was no physical or emotional risk to the participants and participation in the study was completely voluntary.

The pre-intervention survey response participants (*n* = 34) included thirty-three elementary classroom teachers who teach kindergarten, first, second or third grade, and one participant who identified herself as a substitute teacher/ESS teacher. Participants were in eighteen different states across the United States; half of the respondents (50%, *n* = 17) were second grade teachers, ten were first grade teachers, five taught kindergarten, one taught third grade, and one designated herself as "other". Most of the participants (77.1%, *n* = 27) taught in public schools. The rest of the participants indicated they taught in private schools (11.4%, *n* = 4); charter schools (5.7%, *n* = 2) or other (5.7%, *n* = 2). One participant noted that she worked at a Tribal school and marked both private and other for school type. All participants (100%) were female and ranged in age from twenty-five to sixty-four years old with the largest group (38.2%) in the 35 to 44-year-old range. All participants had a college degree, with 41.2% of the participants (*n* = 14) holding a bachelor's degree and the remaining 58.8% (*n* = 20) a master's degree; none had earned a doctorate. Every participant was a classroom teacher and ranged in teaching experience from being brand-new teacher to teaching in the classroom for over ten years.

Pre-intervention results were returned in the Qualtrics® platform and then exported to IBM© SPSS© Version 25 for analysis. Teacher's demographic data were compiled to give an overall outline of the participant's age, education, and classroom experience. In addition to demographic data, survey questions asked participants to provide information about how they prepared for lessons and if they had previously used any kind of digital presentation to teach the math curriculum in their classrooms. If teachers had previously used digital presentations, additional questions were presented to determine where the teacher obtained the presentations.

The pre-intervention survey was sent via email to the 41 teachers who requested to participate in the study. There were 34 responses, which is an 83% response rate. However, only 12 participants completed both the pre-intervention and post-intervention surveys and the semi-structured interview. As the purpose of the study was to determine how teachers describe the impact of translating teacher's manuals into PowerPoint presentations, only the data from the 12 participants who completed the entire study from start to finish are considered in the results. The initial data from the initial 34 participants are included in Appendix M for further review.

Participants who completed the entire study primarily consisted of teachers that had been in the classroom for over 10 years (n = 8, 66.7%) and taught kindergarten through 2nd grade. Tables one and two below show a breakdown of each statistic.

Table 1

Years Teaching in the Classroom – Final Demographic

	Number	%
1-3 years	1	8.3
4-6 years	2	16.7
7-9 years	1	8.3
10 or more years	8	66.7

Table 2

Participant Grade Level – Final Demographic

	Number	%
Kindergarten	2	16.7
First Grade	4	33.3
Second Grade	6	50.0

Most participants taught in public schools (*n* = 10, 83.3%) and were general education teachers (*n* = 11, 91.7%). Only one participant (8.3%) was in a departmentalized role and solely taught math. As shown in Table 3, participants ranged in age from 25-64, with participants equally represented in the 25-34 (*n* = 3, 25%) and 45-54 age groups (*n* = 3, 25%). All participants had earned a bachelor's degree (*n* = 4, 33.3%) or master's degree (*n* = 8, 66.7%); none had earned a doctorate.

Table 3

Participant Age Range– Final Demographic

	Number	%
25 - 34	3	25.0
35 - 44	2	16.7
45 - 54	4	33.3
55 - 64	3	25.0

As participants were recruited via Facebook, they were located across the United States. California had the most participants (*n* = 3, 25%) followed by Arizona (*n* = 2, 16.7%). The remaining seven participants represented separate states across the country. Table 4 provides a breakdown of the states represented.

Table 4

State in which Participants Teach– Final Demographic

	Number	%
AZ	2	16.7
AR	1	8.3
CA	3	25.0
GA	1	8.3
IL	1	8.3
MO	1	8.3
NV	1	8.3
UT	1	8.3
WA	1	8.3

Most participants had previously taught with the Engage NY math curriculum (*n* = 9, 83.3%); however, three participants stated that this was their first year teaching with this math curriculum. Table 5 lists the years teaching as reported by participants.

Table 5

Years Teaching Using the Engage NY Math Curriculum

	Number	%
This is my first year teaching Engage NY math.	3	25.0
1-3 years	7	58.3
4-6 years	2	16.7

More than half of the participants (*n* = 7, 58.3%) had used at least one digital presentation to present Engage NY math content. The participants who signified they previously used presentations had, for the most part, been given the presentation by someone else (*n* = 4, 33.3%). One participant reported that she created her own presentations or had purchased them online. In the open-ended response section, participants shared additional details about where they acquired the digital presentations they had previously used in their classrooms. The following statement from Participant D revealed that she was looking for the materials but could not find a format that worked for her:

> I created some myself, but I bought a few on TpT. I also accessed the free presentations on Embarc [https://embarc.online/, Eureka Math Bay Area Regional Consortium, an online community from the Eureka math content], but I did not like the format for 2nd…I prefer to use the interactive PowerPoints in my math lessons rather than the white board. I did not find I had enough time to create them all on my own and many that were free were not as kid friendly for my second graders.

Intervention

I created PowerPoint presentations for daily kindergarten, 1st grade, 2nd grade, and 3rd grade math lessons using the Engage NY math curriculum (see Appendices F, G, H, I for kindergarten, 1st grade, 2nd grade, and 3rd grade samples). The Engage NY curriculum is available online at https://www.engageny.org/common-core-curriculum and is free for anyone to access. The curriculum was one of the first standards aligned open educational resources and was created through a partnership between the state of New York and the nonprofit Great Minds (creator of Eureka Math) and funded through New York state's $700 million federal Race to the Top award in 2010 (Heitin, 2016; Kaufman et al., 2017). In terms of flow and content, the presentations followed the Engage NY teacher's manuals that are found on the Engage NY website. Each presentation incorporated various educative curriculum features from existing manuals in terms of teacher instruction and prompts to encourage student thinking. I added additional components in the form of visual models and clip art to engage students during the lesson presentations, but the content of the presentations did not vary from the teacher's manuals.

After completing the pre-intervention survey, each participant received a link to an online folder that contained the PowerPoint presentations to use during the intervention in the fall of 2018. Depending on the grade level they taught, the participants received between 40-50 PowerPoint presentations to use during their daily math classes for the first part of the year. I did not provide an entire years' worth of Engage NY math presentations initially, as I wanted to determine if participants would request the rest of the presentations to use in their classrooms when the study was finished in December. As the participants were located across the United States, it was not possible to observe their classrooms prior to the start of the intervention; therefore, the baseline for the teacher's use of digital presentations in relation to content instruction was generated from self-reported, pre-intervention survey responses.

Instrumentation

The research questions guiding this study focus on two key sets of constructs: 1. Teachers' planning, preparation, and pacing, and 2. Teachers' perceptions of their own pedagogical content knowledge. I used a combination of quantitative and qualitative instruments including a researcher created survey instrument and interview protocol to capture both constructs. The survey instrument and interview protocol are explained below in more detail. The full surveys administered before (pre-intervention survey) and after (post-intervention survey) the intervention through Qualtrics©, can be found in

Appendices E and Appendix F respectively, and the full interview protocol can be found in Appendix L.

Survey Instrument. Prior to beginning this study, with the use of informal data collection procedures such as impromptu interviews with coworkers, I learned that many teachers consider lack of time to plan and prepare to teach the individual Engage NY math lessons to be problematic. Teachers also mentioned that keeping up with the required pace of the curriculum was a concern. To determine if teacher participants in this study shared the same mindset as my coworkers, I created a survey instrument that, using Likert-type scales, asked participants to rate their level of agreement with various statements concerning the constructs of lesson planning, preparation, and pacing. The survey also included open ended questions, which allowed participants to share additional information they felt was important. Additionally, participants were asked to report the amount of time they spent weekly preparing to teach the Engage NY math lessons.

Planning, preparation, and pacing**.** To quantitatively measure lesson *planning*, I included four items on the pre-intervention survey and the same four, plus one additional, items on the post-intervention survey. The response options were captured by a four-point Likert scale, ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). To quantitatively measure teachers' *preparation*, I asked participants to specify the approximate number of hours they spent on lesson preparation by choosing from the following options: "1 = none", "2 = less than 1 hour", "3 = 1-2 hours", "4 = 2-4 hours", "5 = more than 4 hours". I asked the same question on pre-intervention and post-intervention surveys, and to the latter I also added another item that asked participants to rate the following statement: "Using the PowerPoint presentations saved time in lesson planning and preparation", using a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

Finally, to quantitatively capture teachers' perceptions of lesson *pacing*, I included four items on the pre-intervention survey and the same four items plus two additional items on the post-intervention survey. Participants evaluated statements regarding their overall outlook on digital presentations and scored statements such as "digital presentations are engaging" and "digital presentations improve lesson flow" using a four-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

Interviews. Between completing the pre-intervention survey and the post-intervention survey, participants completed an interview (Appendix L), in which they were asked nine open ended questions. The first two questions addressed the constructs of lesson planning, preparation, and pacing as they prompted participants to describe the impact using the PowerPoint presentations had on these specific elements. Additionally, to address PCK, I asked participants to evaluate and determine if they felt the use of the PowerPoint presentations helped them to improve their own content knowledge of Engage NY math and to explain mathematical concepts more clearly to their students. For additional background information, I asked each participant to describe any professional development sessions they had attended that focused on creating presentations. To determine if participants felt the presentations were helpful enough to continue using, I asked if they would be interested in receiving the rest of the presentations to continue using in their classroom. The last question asked participants if they had any other comments they would like to share.

Pedagogical Content Knowledge. Measuring PCK is common for evaluating teacher pedagogy but it is a difficult task because researchers are attempting to measure a construct which is still being defined and explored (Alonzo, 2007). At the time of this study, there was no single established approach to measure PCK, although scholars agreed that it is most typically and accurately captured by observation of instruction, teacher interviews, and assessment of content knowledge (Morrison & Luttenegger, 2015). Various instruments have been used in the past to measure PCK, but most of those instruments were in small, qualitative studies that focused solely on teacher's content knowledge in various content areas (Schilling, 2007), or they explored teacher's knowledge of pedagogy but not as it related to teaching a specific content area (Rowan et al., 2001).

Rowan et al. (2001) found that the survey research studies they reviewed only indirectly measured teachers' practical knowledge. The researchers created their own bank of survey questions consisting of multiple-choice questions embedded within fictional classroom scenarios. The multiple-choice questions were designed to measure a single aspect of teachers' content knowledge or knowledge of students' thinking. The results were mixed, and the authors acknowledged that it was still undetermined if survey items could be used to construct reliable scales to measure teachers' pedagogical content knowledge. Measuring PCK is complex, and triangulating results from various data sources is necessary if researchers want to create an accurate assessment of any classroom interaction (Morrison & Luttenegger, 2015).

I could not find an instrument that measured a teacher's perception of their own PCK or the constructs of planning, preparation, and pacing that I addressed in this study.

As I could find no other studies that follow my same line of inquiry, I determined as the researcher that I would need to create both the survey questions and interview questions for the study. To address PCK, participants were asked in both the survey and interview to evaluate and determine if they felt the use of the PowerPoint presentations helped them to improve their own content knowledge of Engage NY math and to explain mathematical concepts more clearly to their students. The pre-intervention survey included a total of nine PCK-specific items, and the post-intervention survey included the same nine items plus one additional item. I divided these items into two sets based on their conceptual focus as well as their differing response options. The survey items for PCK are discussed in further detail below.

The first set of survey questions, which I labelled “PCK-Understanding”, consisted of five items on the pre-intervention survey and six items on the post-intervention survey. Participants were asked to rate their agreement with these statements that proxied their general understanding of PCK on a 4-point Likert scale ranging from 1 (*strongly disagree*) to 4 *(strongly agree*). The pre-intervention survey included the following statements: Digital presentations (PowerPoint, Prezi, etc.) allow the presenter to tell a story with pictures and key phrases; Digital presentations (PowerPoint, Prezi, etc.) help teachers understand content on a deeper level; Digital presentations (PowerPoint, Prezi, etc.) help teachers explain concepts in student friendly language; Digital presentations (PowerPoint, Prezi, etc.) help the presenter organize key concepts and Digital presentations (PowerPoint, Prezi, etc.) allow support teacher learning. The post-intervention survey included each statement above and added the statement: It is easy to teach the math lesson using digital presentations. These questions pertained to teachers' knowledge about different dimensions of PCK, not their personal use of different practices.

In contrast, the second set of PCK-related items, which I labelled "PCK-Performance", asked participants to evaluate their *own* abilities on the following: How well do you… 1) understand the teaching strategies presented in the Engage NY math curriculum, 2) demonstrate and model the concepts, 3) present and work through word problems, and 4) summarize the learning objective. The pre-intervention and post-intervention survey included the same four PCK-Performance questions. However, important to note is that while the item stems were the same for both the pre-intervention and post-interventions, I inadvertently changed the response options for this set of items measuring self-reported performance related to pedagogical content knowledge. The pre-intervention score scale was as follows: 1 = "very well"; 2 = "moderately well"; 3 = "slightly well"; 4 = "not well at all". The post-intervention scale was similar, but for the highest level of agreement, the wording was slightly different. The pre-intervention scale was a 1 and labeled "very well' and the post-intervention scale, while also scored a 1, was labeled as "extremely well". Also, an extra scale score was added on the post-intervention survey between and highest level of agreement and "moderately well". The post-intervention score scale was as follows: 1 = "extremely well"; 2 = "very well"; 3 =" moderately well"; 4 = "slightly well"; 5 = "not well at all". To correct this, post-intervention scores were recoded to match the pre-intervention scale with "extremely well" and "very well" combined and scored as "1".

Data Collection Procedures

In this mixed-methods action research study, both quantitative and qualitative data were collected from a variety of sources including pre-intervention and post-intervention questionnaires, interviews with teachers, and my notes as the researcher. Once all participants were identified, each received a recruitment form via email to attain consent to participate. Prior to sending out any correspondence to participants, I received an exemption to conduct this study from the Arizona State University Human Subject Internal Review Board on July 18, 2018 (Appendix K). The data collected for this study consisted of, in chronological order, pre-intervention surveys, interviews, and post-intervention surveys.

Pre-intervention surveys. Participants were sent a link to the pre-intervention survey via email and asked to complete the online survey consisting of 42 survey items (Appendix E). The survey instrument contained verbiage that indicated the purpose of the study and confirmed that completing the survey signified implied consent, which allowed me to publish any data collected. The pre-intervention survey collected data about teacher's perceptions of digital presentations and gathered demographic data about the participants including gender, age range, formal education, length of time in the classroom, current grade level and their perceived familiarity with the math curriculum.

Once the pre-intervention survey was completed by the participant, I received an automatic email from Qualtrics© indicating it had been submitted and then sent a follow up email to each individual participant with a link to an online folder giving them access to the PowerPoint presentations for the grade level they were currently teaching. After the initial data from the survey was collected and the intervention was introduced to participants, I continued completing observational logs noting any contact with participants and in September 2018, sent a one question survey via Google Forms asking participants to advise what their preferred format would be for the upcoming interviews. The entire process occurred over a period of several months in 2018. While I began contacting the leadership in my previous school district during the winter of 2018, the intervention, including pre-intervention and post-intervention surveys and interviews occurred from August 2018 to November 2018.

Interviews. The pre-intervention survey was completed prior to the interviews to allow me to become familiar with the participant's demographics and to consider any issues that could be specific to the participant's local context. Qualitative data was then gathered through semi-structured participant interviews. Participants were able to choose their interview format from the following options: over the phone, one on one or in a small focus group; via video conference one on one or in a small focus group; in writing (typing the answers and sending them electronically) or "other", which allowed teachers to suggest an alternative method of responding. Participants who requested to complete the interview process in writing received an email link to a Google Form with nine interview questions (Appendix L). The one-on-one interview completed via telephone was recorded with the participant's permission and lasted approximately 11 minutes. Verbal consent was obtained during the recorded interview and participants who completed their interview in writing gave consent by completing and returning the form. To begin each interview, I asked the teacher-participants about their journey as an educator. This information helped me to gain a better understanding of their teaching conditions and practices. The interviews were descriptive, and I tried to be alert to any commonalities in the responses. My interview questions focused on the participant's experiences and asked for the participant's own interpretations of their current situations.

The semi-structured interview included a total of nine questions that focused on participants' perceived impact of the PowerPoint presentations used in the study had on the lesson planning, preparation, and pacing. Participants were also asked if the presentations helped them to improve their own content knowledge or to explain mathematical concepts more clearly to their students and if they felt the presentations aided in their students' learning. Participants were also invited to provide information about any type of professional development concerning creating digital presentations, if applicable. As participants were initially given a portion of the year's lessons when they began the study, they were asked if they would like to receive the rest of the year's presentations to continue using in their classroom. Finally, participants were given the opportunity to provide any additional comments they may have had.

Data from the interviews included participant's perceptions of, and attitudes toward, digital presentations. Once the interviews were completed and had been coded, results were analyzed to look for any overlap between the qualitative data and the quantitative data obtained in the survey and to reveal the categories and themes of the findings. Some of the data from the interviews was used to provide clarification or to expand on answers included in the pre-intervention survey. By collecting both quantitative and qualitative data, I was able to incorporate the strengths of both methodologies (Johnson & Onwuegbuzie, 2004).

Post-intervention surveys. A link to the post-intervention survey (Appendix F) was sent after the interviews were complete. Twelve participants completed the final survey. The post-intervention survey asked participants to confirm their grade level and number of years they had taught in the classroom. Next, the participants were asked to provide an evaluation of the Engage NY Math PowerPoint presentations they used during the study. Participants were invited to provide their opinion based on their experience with the presentations and rate them based on their own expectations of what should have been included in the presentations. The instructions in the survey indicated that there were no right or wrong answers, and that participants should select the answer that best matched their beliefs. The questions asked teacher participants to approximate how much time they spent preparing for the math lessons and to indicate if using the presentations changed their lesson pacing. Participants were also asked if they changed how they prepared to teach a lesson and to evaluate the thoroughness of the presentations, student engagement, and ease of teaching using the presentations.

Researcher log/notes. Throughout the study, beginning with my initial recruitment of participants, I kept both digital and manual logs of any interactions I had with the participants and of my own general observations. In addition to filing any email correspondence in digital folders, I kept a handwritten journal with notes about participant’s responses, their questions about the intervention and noted any future issues that I believed may affect the study. These notes were used during both quantitative and qualitative data analysis to provide an additional point of reference and to remind me of my own observations. For example, I noticed that the participants who were actively participating in the study were more tenured than those who did not complete either the surveys or interview. This was surprising to me as I had believed that new teachers would be more interested. Notes were taken intermittently on an as-needed basis based throughout the study.

Role of the Researcher

My role as the researcher primarily involved facilitating the intervention and data collection. I sent an introductory email to the teacher participants in early August 2018 to introduce myself, the intervention, and help with integrating the digital presentations into their lessons. I advised the participants that I was a classroom teacher and the creator of the digital presentations. The format of the presentations was provided, and the participants were advised that the presentations included the required content presented in the teacher's manuals. I kept a journal in which I noted my interactions with the teacher participants, paying attention to any feedback or questions from them. I was interested not only in their initial reaction to the concept of teacher's manuals translated into digital formats, but how they would interpret the presentation's use in their own classroom.

As the researcher, I needed to empathize with the participant's concerns about the Engage NY math curriculum and the proposed intervention without allowing them to influence my own position. During the introduction of the intervention and the interview process, I maintained a professional decorum and ensured that my own views did not influence the interview outcome in any way. As I introduced the intervention of the digital presentations, I remained neutral about any possible benefits of using the slides to present the math content. One teacher asked what they should do if they did not like the intervention and wound up not using it in their classroom. I informed the participant that I would like an honest response and would ask her to clarify why the presentations were not helpful in her interview. I explained to all the participants that this was a voluntary study and that they should do what they considered to be best for their classroom.

Data Analysis

The research study included both quantitative and qualitative data analysis to answer the research questions. The data was analyzed both separately and then together to look for any relationships. Data analysis procedures are described below.

Quantitative data. Once responses from the pre-intervention and post-intervention surveys were gathered in Qualtrics©, that data was downloaded into an IBM© SPSS© Version 25 file and then analyzed using various statistical procedures including reliability analysis, descriptive statistics, and paired sample *t*-tests. To determine the reliability (or internal consistency) of the instrument and to investigate how closely related the questionnaire items were, a reliability analysis was carried out for the pre-intervention and post-intervention survey questions using IBM© SPSS© Version 25 software on each construct for research question one: lesson planning, preparation, and pacing. The Cronbach's alpha reliability coefficient scores normally ranges between 0 and 1, with results closer to 1 indicating greater internal consistency of the items in the scale. George and Mallery (2003), provide the following guidelines for interpreting Cronbach's alpha scores: $\alpha > .9$ Excellent, $\alpha > .8$ Good, $\alpha > .7$ Acceptable, $\alpha > .6$ Questionable, $\alpha > .5$ Poor, and $\alpha < .5$ Unacceptable (p. 231).

Then the data was analyzed using descriptive statistical procedures to explain the basic features of the data including frequency, mean, and standard deviation. The descriptive statistics confirmed there were no major anomalies, that the means were within the range of possible values, and there were no unusually large variances (Green

& Salkind, 2014). Finally, because the study included a repeated measure of survey questions in the pre-intervention and post-intervention which resulted in pairs of responses, a paired sample *t*-test was used to determine whether the mean difference between the two scores was "…different from zero in the population" (Green & Salkind, 2014, p. 151).

Qualitative data. Clark and Creswell (2014) assert that qualitative research gives us a different approach for data analysis because "…the data in qualitative studies consist of words and pictures, not numbers. Rather than using statistics, researchers analyze the gathered words to describe the central phenomenon under study" (p. 66). The qualitative data in this study was comprised of responses from semi-structured interviews, results from the open-ended survey questions and researcher notes. My goal was to collect and evaluate participant responses that once analyzed, would produce meaningful statements and develop into themes about the essence of the experience (Clark & Creswell, 2014).

I began the process of making sense of my data by converting the interview responses, which I collected in a Google© Form (Appendix L), into a spreadsheet and I transcribed the single phone interview I conducted verbatim and added that response to the spreadsheet. To familiarize myself with the data, I read and then re-read participant's responses to the interview questions as well as their responses to any open-ended survey questions and made observational notes about my general impressions.

To analyze the qualitative data, I used thematic analysis to identify patterns or themes within data (Braun & Clarke, 2006). I explored the data thoroughly as I reread the responses line by line and labeled relevant pieces about actions and activities looking for any patterns. Hatch (2002), states that a pattern can be characterized by determining if things happen in either the same or predictably different ways; how often they happen, the order in which they happen, if they happen in relation to one another or if one thing appears to cause another (p. 155). Using the patterns that I observed from reviewing participant responses, I then created codes. Saldaña (2016), defines a code as "…a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (p. 3). I did not have a predetermined list of codes; therefore, I coded the interviews using open coding noting any similarities, differences, frequencies, sequences, causation, and correspondence (Saldaña, 2016) to break down, compare, and categorize the data (Creswell 2003; Strauss & Corbin, 1990).

I sought to determine if and how the participants' responses were related and then I labeled them in general terms. Some codes were created using the participant's own words, or "in vivo" codes. Things that were coded were items that were either repeated by different participants or were things that I found surprising. To keep the initial codes organized, I color coded responses within the spreadsheet to highlight data that appeared to interrelate and then I evaluated those codes to look for connections that may have been overlooked and to determine which were significant. Finally, I searched for common characteristics in participant's answers that connected the codes from the interviews to the quantitative and qualitative results from their survey responses.

Reliability. Reliability examines the consistency of individual results when repeatedly measuring the same property. Thayer-Hart, Dykema, Elver, Schaeffer, and Stevenson (2010) argue that reliability is at risk for samples in web surveys as the target population may or may not have access to the required technology and the survey could appear different to different participants (p. 15). The survey creation software Qualtrics© used in this study, allowed me, as the researcher, to view the surveys created in both the online and mobile views; therefore, I was able to go through the survey to ensure ease of use for participants. To confirm the general reliability of my survey instrument, the alpha coefficient was run for both pre-intervention and post-intervention metrics.

Though this study relied on a combination of both quantitative and qualitative data, the most significant findings related back to participant's accounts and therefore focused more on qualitative results. However, as the participants were from across the country, in various states and across varying grade levels, the commonalities found in their responses to open ended questions were worth considering and point to the reliability of the qualitative data collected in this study. The participants consistently indicated that they found value in the presentations and thought them to be helpful when considering the lesson planning, preparation, and pacing. Reliability is still a concern however, as the survey items were designed to measure a teacher's own perceptions, which is difficult to determine whether future scores would be consistent as no two responses will likely ever be the same.

Validity. Validity is a measure of how correct, useful, meaningful, and appropriate the researcher's inferences are and for quantitative research, the extent to which a question measures what it is supposed to measure (Thayer-Hart et al., 2010; Fraenkel & Wallen, 2009). In qualitative research, validity refers to the relevance and suitability of various aspects of the study, including: the choice of methodology, sampling, and data analysis (Leung, 2015). Triangulation allows the researcher to verify the accuracy of the data by cross-checking information, and in this study participant survey responses, including open ended questions, researcher notes, and participant interview responses were reviewed both separately and together to determine the dependability of the data.

Smith and Glass (1987) assert that the first consideration of external validity is to determine if the results are true for solely the sample of subjects who participated, or true for a broader group. To address this concern, ideally researchers should use random selection to choose participants. However, as the very nature of an action research project is to address a local problem that is typically smaller in scale, the idea of applying findings to a larger group is not necessarily the prime objective. As an action researcher, my goal was to find a solution that would apply to my specific problem of practice, therefore, the results of this study may not apply to the general population. Although the questions in the survey instrument and interview protocol specifically asked participants to address the research questions, there were still several threats to the validity of this study. Those threats are discussed below.

Threats to validity: Threats to validity for this action research study may have included nonequivalence, attrition, the Hawthorne effect and novelty (Smith & Glass, 1987). Participants in the study sample had characteristics that made them unequal including education level, time in the classroom, familiarity with the content, and current teaching environment. Nonequivalence is best controlled by random assignment which was not possible. A few participants were lost due to attrition, which refers to the number of participants who do not complete the entire study. To address attrition, I considered if the subjects who completed the study had different characteristics from those who dropped out. Another threat to validity may have been caused by the Hawthorne Effect in that participants could have acted differently because they knew they were part of a study. The improvement or perception that participants reported may have been caused by the feeling of special treatment and could have been mistaken for any effect from the intervention. Finally, novelty may have threatened validity because the results of the study may or may not be duplicated if the intervention were to be repeated the next year, after the novelty wears off.

Summary

In this mixed methods action research study, teacher-participants in public, private, and charter schools who taught the Engage NY math curriculum in kindergarten through third grade across nine states used researcher created presentations in their classrooms to teach Engage NY math content. Before and after implementing the intervention presentations, participants completed pre-intervention and post-intervention surveys created by the researcher to obtain demographic data as well as the participant's views of digital presentation use in the classroom. Participants also completed an interview between the pre-intervention and post-intervention survey which asked them to reflect on the use of the PowerPoint presentations in their classrooms, and to indicate if they felt the presentations helped them to improve teaching the Engage NY math content and to evaluate if using the presentations had any impact on their lesson planning, preparation, and pacing.

Chapter 4

Analysis and Results

Chapter 4 consists of the results of the analyses from quantitative and qualitative data collected throughout the study. The findings are organized by the two research questions:

> RQ1: How do teachers describe the impact that pre-made digital slide share presentations (i.e., PowerPoint presentations) have on lesson planning, preparation, and pacing?
>
> RQ2: What impact does translating teacher's manuals into digital slide share presentations (i.e., PowerPoint presentations) have on teacher's pedagogical content knowledge?

Results from the study are presented in two sections for each research question. Each section begins with the quantitative data results from the pre-intervention and post-intervention survey, primarily descriptive statistical data from survey items as well as a comparison of pre-intervention and post-intervention responses where applicable. Next, relevant qualitative data results are summarized, presented and discussed including participant responses to open ended survey questions, interviews, and researcher reflection logs .These multiple sources of data were used to triangulate findings and support data sources (Creswell, 2009). For each research question, the quantitative data are reported first.

Results for Research Question 1: How do teachers describe the impact that pre-made digital slide share presentations (i.e., PowerPoint presentations) have on lesson planning, preparation, and pacing?

Quantitative Results. The purpose of the survey instrument was to explore participant's thoughts and opinions of digital presentations both before and after the intervention. Questions in the survey addressed teacher's perceptions of digital presentations and their own perceived ability regarding teaching the Engage NY math curriculum. To answer research question one, participants rated statements that asked them to evaluate digital presentations overall and rate the effect using the intervention presentations had on their lesson planning, preparation, and pacing. Results are broken down, presented, and discussed below for these three constructs. In each case, I first examined the overall construct's reliability and applied the scale procedures to report Cronbach's alpha. I then analyzed the descriptive statistics for the individual items that comprised the scales as well as the overall construct. Finally, I conducted independent samples *t*-tests to examine the impact of the presentations on teachers' self-reported lesson planning, preparation, and pacing.

Planning. The construct of teacher planning, or what was taught in a lesson, included designing the lesson to incorporate all required concepts, scaffolding content, and incorporating questioning to determine student understanding. The planning scale consisted of four items on the pre-intervention survey. All individual items were measured on a four-point Likert scale, with "strongly agree" assigned a value of 4; "somewhat agree" were valued at 3; "somewhat disagree" valued as 2 and "strongly disagree" responses were given a value of 1.

In terms of the reliability of the overall planning construct, the four items grouped together in the pre-intervention survey at an acceptable level, with $\alpha = 0.79$. I conducted an item-total statistics analysis for each construct to determine if the Cronbach's alpha score would increase or decrease if specific items were deleted. Table 6 provides a detailed list of deletion scores and shows that three items in the pre-intervention survey either stayed the same or resulted in a decrease in the alpha if deleted except the item: Digital presentations encourage questions from students in which that alpha would increase from .79 to .80; as such, no items were considered for removal.

Cronbach's alpha increased in the post-intervention survey and presented an excellent reliability with $\alpha = 0.92$, suggesting that the items have relatively high internal consistency. The internal consistency increased from pre-intervention to post-intervention even though the questions did not change. In the post-intervention reliability analysis, the removal of most of the individual items would result in a decrease in the alpha if deleted; however, the one exception to this was the item that asked teachers to consider if digital presentations support student learning through increased understanding, which would increase the alpha to $\alpha = 0.94$, therefore removal of this item could be considered. Table 6 below lists the deletion scores for all items.

Table 6

Deletion Scores Planning Construct

	Scale Mean if Item Deleted		Scale Variance if Item Deleted		Corrected Item-Total Correlation		Squared Multiple Correlation		Cronbach's Alpha if Item Deleted	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased understanding.	9.75	10.50	2.20	4.45	.71	.71	.64	.63	.68	.94
Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased engagement.	9.83	10.42	2.52	3.72	.51	.84	.28	.77	.79	.89
Digital Presentations (PowerPoint, Prezi, SMART board, etc.) encourage questions from students.	10.33	10.75	3.15	3.30	.48	.84	.37	.79	.80	.90
Digital Presentations (PowerPoint, Prezi, SMART board, etc.) encourage students' participation.	10.08	10.58	1.90	2.99	.77	.96	.70	.91	.65	.85

To understand the possible impact of digital presentations on teacher planning, I examined descriptive statistics for the four items on both pre-intervention and post-intervention surveys (see Table 7). Every individual item saw an increase in its post-intervention scores with the highest increase in the item: Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage students' participation and the smallest increase in the item: Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased understanding. Participant's responses on all items indicated they either "strongly agreed" (value of 4) or "somewhat agreed" (value of 3) when they completed the pre-intervention survey, and the same was true in the post-intervention survey. The standard deviations decreased for two of the statements: Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased understanding and Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased engagement. The standard deviations increased for the other two statements: Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage questions from students and Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage students' participation. Table 7 shows a breakdown of the data.

Table 7

Individual Item Statistics – Planning Construct

Item	Pre-Intervention *N = 12*		Post-Intervention *N = 12*	
	M	*SD*	*M*	*SD*
Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased understanding.	3.58	.67	3.58	.51
Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased engagement.	3.50	.67	3.67	.65
Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage questions from students.	3.00	.43	3.33	.78
Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage students' participation.	3.25	.75	3.50	.80
Overall Planning Construct	3.33	.50	3.52	.63

Note. *M* = Mean, *SD* = Std. Deviation, *N* = number.

Table 8 shows the results of the mean comparisons of the pre-intervention and post-intervention surveys using paired sample *t*-test. While there was an increase in the mean scores, participants did not report a statistically significant difference regarding the planning construct from pre-intervention (*M* = 3.33, *SD* = .50) to post-intervention (*M* = 3.52, *SD* = .63), t(11) = -.85, p = .41.

Table 8

Paired Samples Test – Planning Construct

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre & Post	-.19	.76	.22	-.67	.30	-.85	11.00	.41

Preparation. Next, analyses were conducted on items hypothesized to assess teacher perception of lesson preparation. Lesson preparation included the time spent creating the presentations. I measured preparation with one item on the pre-intervention survey and post-intervention survey, so I did not create a composite scale for this construct or conduct reliability analyses. Participants quantified the approximate number of hours they spent on lesson preparation by choosing from the following options: “1 = none”, “2 = less than 1 hour”, “3 = 1-2 hours”, “4 = 2-4 hours”, “5 = more than 4 hours”.

Tables 9 and 10 provide the item statistics and paired sample *t*-test results. The descriptive results suggest that participants spent less time (*M* = 2.42, *SD* = .67) before the intervention than they did after (*M* = 3.00, *SD* = .74) and the paired sample *t*-test did not report a statistically significant difference *t*(11) = -2.03, p = .07 between the pre-intervention and post-intervention means.

Table 9

Item Statistics - Preparation Construct

	Pre-Intervention *N = 12*		Post-Intervention *N = 12*	
	M	*SD*	*M*	*SD*
Approximately how many hours do you currently spend preparing to teach Engage NY math content for any given lesson (do not include time spent making copies and/or organizing physical materials).	2.42	.67	3.00	.74

Note. *M* = Mean, *SD* = Std. Deviation, *N* = Number.

Table 10

Paired Samples Test – Preparation Construct

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre & Post	-.58	1.00	.29	-1.22	.05	-2.03	11.00	.07

The post intervention questionnaire included a separate question that asked participants to rate their level of agreement with the statement, "Using the PowerPoint presentations saved time in lesson planning and preparation". As the statement groups planning and preparation into one item, I considered this question separately from the two individual constructs as I cannot discern which construct would be affected. As with previous survey questions, individual items were measured on a four-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*). The responses showed a final mean score halfway between "somewhat agree" and "strongly agree" (*M* = 3.50, *SD* = .80) indicating that participants felt the use of the presentations saved them time in planning and preparation.

Pacing. Teacher pacing captured how content was presented, addressed the structure of the lessons to ensure student interest and kept both students and teachers on task. The pacing scale consisted of four items on the pre-intervention survey and six items on the post-intervention survey. Participants evaluated statements regarding their overall outlook on digital presentations and scored statements such as "digital presentations are engaging" and "digital presentations improve lesson flow" using a four-point Likert scale ranging from 1 (*strongly disagree*) to 4 (*strongly agree*).

In terms of the reliability of the overall pacing construct, Cronbach's alpha indicated that the pre-intervention survey was excellent, with $\alpha = 0.92$. Two items in the pre-intervention survey: Digital presentations are engaging, and Digital presentations improve lesson pacing resulted in a decrease in the alpha to .87 if deleted and the other two items showed a slight increase. Overall, Cronbach's alpha increased slightly in the post-intervention survey and again indicated excellent reliability with $\alpha = 0.94$, suggesting that the items have extremely high internal consistency. The removal of four of the individual items would result in a decrease in the alpha if deleted and removal of one of the two items that was not on the pre-intervention survey would maintain the alpha at $\alpha = 0.94$. No items were considered for removal. Table 11 provides a detailed list of deletion scores.

Table 11

Deletion Scores - Pacing Construct

	Scale Mean if Item Deleted		Scale Variance if Item Deleted		Corrected Item-Total Correlation		Squared Multiple Correlation		Cronbach's Alpha if Item Deleted	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Digital presentations (PowerPoint, Prezi, SMART board, etc.) are engaging.	10.75	18.00	3.48	8.18	.93	.93	-	-	.87	.91
Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage the presenter to interact with their audience.	10.92	18.08	2.99	8.08	.78	.93	-	-	.95	.91
Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson pacing.	10.75	18.00	3.48	9.45	.93	.78	-	-	.87	.94
Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson flow.	10.58	18.00	4.45	9.27	.83	.85	-	-	.93	.93
Using the PowerPoint presentations saved time in lesson pacing.	-	18.17	-	8.70	-	.73	-	-	-	.94
The digital presentations kept students engaged throughout the lesson.	-	18.08	-	7.17	-	.85	-	-	-	.93

Next, I examined the descriptive statistics for all individual items that comprised teacher perceptions of pacing, as well as the overall construct (Table 12). All items saw an increase in their mean scores except for the question relating to lesson flow, which showed a slight decrease from pre-intervention survey results (M = 3.77, SD = .44) to post-intervention survey results (*M* = 3.67, *SD* = .49). The largest increase from pre-intervention survey results (*M* = 3.38, *SD* = .87) to post-intervention survey results (*M* = 3.58, *SD* = .67) was in the item: Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage the presenter to interact with their audience. Two items shared the same mean increase from pre-intervention (*M* = 3.62) to post-intervention (*M* = 3.67): Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson pacing and Digital presentations improve lesson pacing.

Table 12

Individual Item Statistics-Pacing Construct

Item	Pre-Intervention *N = 12*		Post-Intervention *N = 12*	
	M	*SD*	*M*	*SD*
Digital presentations (PowerPoint, Prezi, SMART board, etc.) are engaging.	3.62	.65	3.67	.65
Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage the presenter to interact with their audience.	3.38	.87	3.58	.67
Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson pacing.	3.62	.65	3.67	.49
Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson flow.	3.77	.44	3.67	.49
Using the PowerPoint presentations saved time in lesson pacing.	-	-	3.50	.67
The digital presentations kept students engaged throughout the lesson.	-	-	3.58	.90
Overall Pacing Construct	3.58	.62	3.60	.57

Note. *M* = Mean, *SD* = Std. Deviation, *N* = number.

The overall Pacing Construct mean increased slightly from pre-intervention (*M* = 3.58, *SD* = .62) to post-intervention, (*M* = 3.60, *SD* = .57). Results from the Likert-scale questions were then combined and evaluated to determine if there was a significant statistical difference between pre-intervention and post-intervention scores. While there was a slight increase in the mean for lesson pacing, the results were not statistically significant $t(11) = -.08$, $p = .94$. Table 13 shows the results of the paired samples *t*-test for the lesson pacing construct.

Table 13

Paired Samples Test – Pacing Construct

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre & Post	-.02	.76	.22	-.50	.47	-.08	11.00	.94

Qualitative Results. In this action research study, I sought to describe the impact PowerPoint presentations could have on lesson planning, preparation, and pacing based on the teacher's experience. To better understand the individual participant experience and how teachers felt about using the presentations provided during the intervention, I collected qualitative data from interviews, open-ended items on the post-intervention survey, and my researcher log. The overarching purpose of the qualitative data collected in this study was to uncover teacher's beliefs about PowerPoint use in the classroom, and more specifically if they found any benefit to their use as it relates to lesson planning, preparation, and pacing.

To analyze qualitative data for research question one, I color coded patterns in the interview transcripts, then labeled sections of the text using codes, and then combined the codes under each theme depending on its subject matter. The qualitative data analysis that focused on the first research question produced 35 codes which were then compiled into three themes. The three themes followed the constructs of planning, preparation, and pacing with the assertion that teachers described the impact of the PowerPoint presentations as beneficial for each one. Teacher planning included what was taught in a lesson, designing the lessons, scaffolding content, and incorporating questioning to determine student understanding. Lesson pacing captured how content was presented and addressed the structure of the lessons to ensure that it held student interest and kept both students and teachers on task. Lesson preparation included the time spent creating the presentations.

Responses from teacher interviews were positive regarding lesson planning, preparation, and pacing. All but one participant noted an improvement, and that participant stated she had not used the presentations at all. The connections between the codes and themes revealed that as teachers used the presentations more frequently, they determined that the presentations were concise, comprehensive, and effectively conveyed the main ideas of each lesson. This led to greater understanding for both participants and their students, and as a result, improved their lesson planning, preparation, and pacing. Table 14 provides examples of how I coded some of the interview data.

Table 14

Coding Examples – Planning, Preparation, and Pacing

Code	Theme
focus on main idea	planning
understand structure of the lesson	planning
allows me to spend time on other things	preparation
saves times	pacing
moves lessons along	pacing
stay on track	pacing
less student wait time	pacing
covered content with fidelity	preparation
less transition time	pacing
more natural flow	pacing
teach systematically	planning
visuals saved time	pacing
clarify concepts for teacher and student	preparation
got to meat of the lesson	planning
focus on the essentials	planning
visuals benefitted students	preparation
more natural flow	pacing
teach systematically	planning
visuals saved time	pacing
clarify concepts for teacher and student	preparation

Planning. Several participants remarked that they were able to reduce their planning time because the pre-made presentations allowed them to focus on essential parts of the lesson and spend more time on other areas, such as putting materials together. Participant E said, "…the PowerPoints cut my planning time in half for math because they are clear and concise" and participant L wrote that prior to the study she was spending hours each night reading the lessons to become familiar with them, but now she reads the lesson once, reviews the slide show and she is ready to teach.

Preparation. Participants noted that using the PowerPoint presentations changed how they prepare for lessons. Participant B said:

> I planned the lessons differently in I looked at the first and last to see the progression and [then] planned each lesson individually. Having the presentations cut down on the time needed to review each lesson considerably. Additionally, it cut down on the number of times I needed to read the teaching [manual] because they were easy to follow along in the planning process.

Participant F mentioned that “It helps me be more organized and it helps cut down on the prep work for each lesson”. Other participants used their new-found time to enhance their current teaching practices and focus on teaching in different ways. For example, Participant E stated, “I've used [the PowerPoints] for teaching prep; discovering other sources for support, this process has enabled me to utilize what I learn for the class and for small group development”.

Several participants commented on how the presentations helped them to feel more prepared. Participant H noted an improvement in her organization and stated that “The [PowerPoints] help me organize my thinking because the lessons are laid out for me” and Participant G offered the following insight regarding her process:

> Now instead of reading the dry and confusing material in the manual, and having that be my only resource, I go through the PowerPoint presentation to see what the lesson is about and how to teach it. Then if necessary, I go to the manual to clarify. I don’t use the manual very much because the PowerPoints explain the

> lesson very well. It’s easier for me to understand what to teach and easier for my students to learn too.

Participant C also addressed preparedness and stated “I was more prepared with all the necessary pieces. Everything was ready to go, and my math time was reduced because there was not as much wait time”.

Pacing. Participants’ comments suggested that they felt the flow was more natural and there was less wait time for the students. Participant E stated:

> Lesson pacing was improved because there was no need to prep as we went. It kept the lesson running smoothly and allowed for less wait time. I know that by the time I got through a [PowerPoint] presentation that I had covered the entire lesson with fidelity.

Similarly, Participant C asserted:

> It makes the pacing go faster [because] I don't have to pull out or search for several resources at once. Having the problem at the beginning already written up saves time. The students can read it and just take a short time to answer then discuss. I think the best thing about the power-points is having them available during instruction to help move lessons along. Eureka [Engage NY] lessons are long, so this helps get as much in [as possible]”.

Participant A noted that there was not a big impact on her day to day pacing, but “…there was an impact on my overall pacing because I could focus on the main ideas and not get bogged down trying to figure out what I should teach”. Likewise, several participants stated that they saved time because they were able to stay on track by just clicking to the next slide instead of flipping through pages in the teacher’s manual. Participant I stated that her average math block was reduced by 10 minutes which allowed her to use that time for art, which had previously been removed from the schedule.

Generally, the participants' evaluations indicated that the presentations were beneficial as they saved them time and effort regarding all three constructs: lesson planning, preparation, and pacing the Engage NY math lessons.

Results for Research Question 2. What impact does translating teacher's manuals into digital slide share presentations (i.e., PowerPoint presentations) have on teacher's pedagogical content knowledge?

While research question one sought to determine the impact that digital presentations could have on lesson planning, preparation, and pacing, research question two sought to understand if participants perceived improvement in their own teaching skills, or pedagogical content knowledge (PCK). Data were collected in both the surveys and interview to address this question.

Quantitative Results. The construct of pedagogical content knowledge captures a teacher's impression of how well they internalized curricular content, as well as a self-evaluation of their own ability to translate, interpret, and decipher the content into student friendly material so that it is accessible to all students. The PCK scale used in this study consisted of a total of nine items on the pre-intervention and 10 items on the post-intervention survey. To analyze the results, I divided the items into two sets based on their conceptual focus as well as response options. The first set (reported below as "PCK-Understanding") consisted of five items on the pre-intervention survey and six items on the post-intervention survey that asked participants to rate their agreement with various statements that proxied their general knowledge and understanding of PCK on a 4-point

Likert scale ranging from 1 (*strongly disagree*) to 4 *(strongly agree*). The next group of questions (reported below as "PCK-Performance") consisted of four items that asked participants to rate statements by indicating how well they felt they personally performed a PCK-related task using a four-point scale ranging from 1 (*very well*) to 4 (*not well at all*). Results for each groups of questions are reported separately below.

PCK-Understanding results. In terms of the overall reliability of the scale that captured teachers' knowledge and understanding of PCK, Cronbach's alpha indicated that the pre-intervention survey was reliable, with $\alpha = .89$. Three items in the pre-intervention survey resulted in a decrease in the alpha if deleted and two showed an increase. Participant's responses showed an increase in Cronbach's alpha from .85 to .94 if the item "Digital presentations (PowerPoint, Prezi, SMART board, etc.) help teachers understand content on a deeper level" was removed and showed an increase in Cronbach's alpha from .90 to .91 if the item "Digital presentations (PowerPoint, Prezi, SMART board, etc.) support teacher learning" was removed. No items were considered for removal. Cronbach's alpha decreased slightly in the post-intervention survey, but the reliability was still high with $\alpha = .88$. The removal of the question that was not on the pre-intervention survey would increase the alpha to $\alpha = 0.90$. Table 15 provides a detailed list of deletion scores.

Table 15

Deletion Scores PCK- Understanding Construct

	Scale Mean if Item Deleted		Scale Variance if Item Deleted		Corrected Item-Total Correlation		Squared Multiple Correlati on		Cronbach's Alpha if Item Deleted	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Digital presentations (PowerPoint, Prezi, etc.) allow the presenter to tell a story with pictures and key phrases.	13.75	14.92	4.39	2.27	.84	.91	-.	-	.88	.86
Digital presentations (PowerPoint, Prezi, SMART board, etc.) help the presenter organize key concepts.	13.75	14.92	4.39	2.27	.84	.91	-	-	.88	.86
Digital presentations (PowerPoint, Prezi, SMART board, etc.) support teacher learning.	14.33	15.08	3.88	2.27	.67	.65	-	-	.90	.91
Digital presentations (PowerPoint, Prezi, SMART board, etc.) help teachers understand content on a deeper level.	14.42	15.17	3.17	2.33	.86	.56	-	-	.85	.94
Digital presentations (PowerPoint, Prezi, SMART board, etc.) helps teachers explain concepts in student friendly language.	14.08	14.92	3.54	2.27	.75	.91	-	-	.88	.86
It is easy to teach the math lesson using digital presentations.	-	18.75	-	3.48	-	.64	-	-	-	.90

I next examined descriptive statistics for the individual items and the overall PCK-Understanding construct, which collectively represented teachers’ overall outlook of how digital presentations affect a teacher and his or her students, both before participating in the intervention and after. Participant's responses showed increased agreement from pre-intervention (*M* = 3.52, *SD* = .49) to post-intervention (*M* = 3.75, *SD* = .37) with the highest increase in the item "Digital presentations support teacher learning" followed by the item "Digital presentations help teachers understand content on a deeper level". The participant's results in the pre-intervention survey indicated they had a favorable impression of digital presentations as the mean was in the "agree" to "strongly agree" range. The post-intervention mean score increased, suggesting that participants had an even more favorable impression of digital presentations at the end of the intervention.

Table 16

Individual Item Statistics PCK-Understanding Construct

Item	Pre-Intervention *N = 11*		Post-Intervention *N = 11*	
	M	*SD*	*M*	*SD*
Digital presentations (PowerPoint, Prezi, etc.) allow the presenter to tell a story with pictures and key phrases.	3.85	.39	3.83	.39
Digital presentations (PowerPoint, Prezi, SMART board, etc.) help teachers understand content on a deeper level.	3.17	.72	3.58	.51
Digital presentations (PowerPoint, Prezi, SMART board, etc.) helps teachers explain concepts in student friendly language.	3.50	.67	3.83	.39
Digital presentations (PowerPoint, Prezi, SMART board, etc.) help the presenter organize key concepts.	3.83	.39	3.83	.39
Digital presentations (PowerPoint, Prezi, SMART board, etc.) support teacher learning.	3.25	.62	3.67	.49
It is easy to teach the math lesson using digital presentations.	-	-	3.50	.80
PCK-Understanding Overall Construct	3.52	.49	3.75	.37

Note. *M* = Mean, *SD* = Std. Deviation, *N* = number.

While there was an increase in the mean for PCK-Understanding from the pre-intervention (*M* = 3.52, *SD* = .49) to the post-intervention survey (*M*=3.75, *SD* = .37), the results were not statistically significant $t(11) = -1.18$, p = .26 as shown below in table 17.

Table 17

Paired Samples Test – PCK Understanding Construct

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre & Post	-.23	.69	.20	-.67	.20	-1.18	11.00	.26

PCK-Performance results. In both the pre-intervention and post-intervention surveys, participants were asked to evaluate their own performance by rating how well they 1) understood the teaching strategies presented in the Engage NY math curriculum, 2) demonstrated and modeled the mathematical concepts presented in each Engage NY lesson, 3) presented and worked through word problems with their students and 4) summarized learning objectives for each Engage NY math lesson. The following data present the findings for both the pre-intervention and post-intervention survey results for PCK-Performance as collected from the participants.

Cronbach’s alpha signified PCK-Performance in the pre-intervention survey had good reliability, with α = .86. Two items in the pre-intervention survey resulted in a decrease in the alpha if deleted and two showed only a slight increase; as such, no items were considered for removal. The overall Cronbach’s alpha decreased in the post-intervention survey with α = .80; however, it still indicated an acceptable internal consistency. The removal of three of the individual items would result in a decrease in the alpha if deleted and removal of the question about summarizing the objective would increase the alpha to α = 0.84. Table 18 provides a detailed list of deletion scores.

Table 18

Deletion Scores PCK- Performance Construct

	Scale Mean if Item Deleted		Scale Variance if Item Deleted		Corrected Item-Total Correlation		Squared Multiple Correlation		Cronbach's Alpha if Item Deleted	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
How well do you understand the teaching strategies presented in the Engage NY Math curriculum?	6.73	4.50	2.62	2.82	.93	.90	.89	.	.73	.68
How well do you demonstrate and model the mathematical concepts presented in each Engage NY lesson?	6.73	4.25	4.62	3.11	.63	.54	.70	.	.87	.79
How well do you present and work through word problems with your students?	6.82	4.25	4.36	1.66	.61	.82	.57	.	.87	.66
How well do you summarize the learning objectives for each Engage NY math lesson?	6.18	4.25	3.36	2.93	.79	.43	.72	.	.79	.84

The overall post-intervention results (*M* = 1.48, *SD* = .53) demonstrated that participants felt more confident with all four items than they did in the pre-intervention survey (*M* = 2.20, *SD* = .63). Participants signified they felt the most growth in their ability to summarize learning objectives for each lesson. Their responses increased from a score that was between slightly and moderately well (*M* = 2.64, *SD* = .81) in the pre-intervention survey to a score in between moderately and extremely well (*M* = 1.50, *SD* = .67) in the post-intervention survey. While participants indicated that they felt the smallest amount of growth in their ability to present and work through word problems with students, they still noted an increase from the pre-intervention (*M* = 2.00, *SD* = .63) to the post-intervention (*M* = 1.5, *SD* = .90). Table 19 provides a breakdown of the individual item statistics.

Table 19

Individual Item Statistics – PCK-Performance Construct

Item	Pre-Intervention *N = 11*		Post-Intervention *N = 12*	
	M	*SD*	*M*	*SD*
How well do you understand the teaching strategies presented in the Engage NY curriculum?	2.09	.94	1.25	.45
How well do you demonstrate and model the mathematical concepts in Engage NY?	2.09	.54	1.50	.52
How well do you present and work through word problems with students?	2.00	.63	1.50	.90
How well do you summarize learning objectives for each Engage NY lesson?	2.64	.81	1.50	.67
PCK-Performance Overall Construct	2.20	.63	1.48	.53

Note. *M* = Mean, *SD* = Std. Deviation, *N* = number.

There was an increase in the mean for PCK-Performance from the pre-intervention (*M* = 2.20, *SD* = .63) to the post-intervention survey (*M* = 1.48, *SD* = .53), and the results were statistically significant *t*(10) = 4.28, p = .00.

Table 20

Paired Samples Test – PCK Performance Construct

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre & Post	.73	.56	.17	.35	1.11	4.28	10.00	.00

Qualitative results. Each interview included questions that focused on the second research question and asked the participants to provide their opinions and personal observations regarding how the intervention affected their *own* PCK. See Appendix L for the full list of interview questions. The qualitative data analysis produced 15 codes that fell within the two constructs of PCK-Understanding and PCK-Performance. The themes followed the constructs and asserted that participants had an improved perception in both PCK-Understanding and PCK-Performance. Table 21 lists examples of codes and the themes in which they were included.

Table 21

Coding Examples – PCK Understanding and PCK Performance

Code	Category/Theme
helped me to become a better teacher	PCK performance
I understand the content and can explain it to others	PCK understanding
PPP pointed out the main idea of each lesson	PCK understanding
I ask better questions	PCK performance
no forgetting a step or skipping important parts	PCK performance
I better understood the big picture	PCK understanding
ensured that I covered everything from the lesson	PCK performance
able to explain mathematical concepts in a clear and concise way	PCK performance

Regardless of their tenure, teacher-participants indicated that they found the use of the PowerPoint presentations to be helpful. Teachers that were new to the curriculum indicated that they found the presentations helped them improve their knowledge of the Engage NY math content. Participant H said, "…the PowerPoint presentations helped me improve my own content knowledge because this is the first year we've used the program and I'm not familiar with where the program starts and ends and what is taught for each lesson" and Participant L stated, "Yes, I'm new to second grade so many of these topics aren't things I covered in first grade. If I had to suggest something, I might suggest a video component. However, these are found both on [Z]earn and YouTube".

Two of the teacher-participants stated that they were already familiar with the content and strategies in the Engage NY math curriculum and did not feel that the presentations helped improve their content knowledge. However, one of those two, participant E, mentioned that having the entire lesson on the slides did prohibit her from inadvertently skipping parts of the lesson and noted:

> I don't believe it helped me with content knowledge. I am pretty well versed in the program and strategies. However, having the content on the board kept the lessons on track and paced out. There was no forgetting a step or skipping important parts. That is invaluable as you go through a program like Eureka/Engage New York.

All participants who used the presentations said they helped them explain mathematical concepts more clearly to their students. Almost all the participants (n = 10) commented on the benefits of having the visual examples available for both themselves and their students.

Participant C stated:

> The visuals are helpful. I get more of the lessons in, so the students are exposed to more content. There have been times that I am unsure of the fluency activities but the visuals and the fact that they are right there makes it easier to just go ahead and do them.

Similarly, participant J remarked “the slides help to summarize and visualize the lessons better. I find I get a better understanding of what to teach”, and participant J said that as she felt more confident in the material, “I even found myself able to explain to other teacher[s] what the teacher's manual was asking us to teach.” Participant E observed that because the presentations allowed her to systematically present the content, there was a benefit for both visual and auditory learners. Others remarked that having an idea worded differently helped them to rephrase it, so their students could attain the information in a variety of ways. Participant G said:

> [T]he PowerPoint presentations absolutely help me to explain the mathematical concepts more clearly. Sometimes it’s hard to think of the correct words to say and the power points helped me to do that easily because you can read it off the slide.

Additionally, a few participants remarked that because they could see the overall progression of each lesson in the PowerPoint slide show, it was easier to see the “big picture” and therefore, easier to explain or model for their students.

When asked if they felt the presentations aided in their students’ learning, every teacher that used the presentations in their classes expressed that they found the presentations to be beneficial. Reasons participants cited included increased student engagement, and improvement in their own understanding as the teacher, which led to improved teaching. Participant G stated, "the manual is pretty complicated, and the power points help me to understand better exactly what I am teaching." Participants commented that the child-friendly format of the presentations added visual appeal and interest for their students. Teacher-participants also used the presentations in alternative ways aside from traditional presentation. Participant I provided her advanced learners with access to the presentations so they could review them on their own and move at a faster pace while she worked in small groups with other students who were struggling.

Overall Impact of the Innovation

Overall, participants in the study described the pre-made PowerPoint presentations as beneficial, noting that they reduced their overall stress and improved their practice. One participant indicated that while she did not have a negative experience, she simply did not use the presentations in her classroom. At the end of the interview, participants were asked if they would like to receive access to the rest of presentations for use in their classrooms. Every participant except participant K, who did not use the presentations at all, said they would like access to them. Participant C stated that she would like to use the presentations as they "…are clearly laid out. They are not too busy. It helps move the lessons along and the visuals are very helpful." Participant D said that she enjoyed using them and that her students have benefited from the addition to their [classroom] routine. Participant E was also interested in receiving the rest of the presentations and added this comparison to another digital presentation currently available to teachers, "I would be interested. I have used the presentations from

[E]mbark. Although they are good there are often mistakes. They also were not as visually engaging or thorough".

Other participants were also eager to receive the rest of the presentations. Participant G stated:

> I use them every day and I feel I am a better teacher because of them. The kids enjoy seeing them and they help me to understand what I'm teaching better. Since I can project it on my whiteboard, the students are able to see the problems and explanations just as I can.

Participant J also mentioned she would like to use the presentations and said:

> Due to the growth I have seen in my students I would love to have all of first and second grade presentations. I could see the benefit in just how my students talk about math and create their smart goals for math.

Participant L gave the most emphatic response stating, "Yes!!! They have been incredibly helpful to me, especially as a first year in a new grade. I would be struggling without these lessons. I can't even begin to tell you how thankful I am for these lessons." The participant's responses and their requests to have access to the rest of the presentations established that they found value in the presentations for several reasons, some of which include increased content knowledge as well as improved experiences with lesson preparation, planning, and pacing.

The post-intervention questionnaire included an open-ended question that directly asked participants if they found value in the PowerPoint presentations used in the intervention. Responses are provided in Table 22 and include a wide range of answers. One participant did not use the presentations at all. The other participants stated that the value they found in the PowerPoint presentations included student engagement, visual representation of content, organization, and time management.

Table 22

Participants Description of the Value They Find in Using the PowerPoint Presentations

Participant's Response	Value Described
Clear visual representations of the teacher's manual. It organized materials in a clear, concise manner that allowed both myself, as the instructor and the students participating to follow the lesson in a chronological and efficient way.	Visual representation of content, organized
I don't have to look in the manuals as much to understand what I'm teaching. I loved the explanations and pictures which made it both teacher friendly and kid friendly.	Kid/Teacher Friendly
I like that it matched the lessons. I have used other PowerPoint that they Were for Engage New York and they didn't really match the lessons. It caused more confusion [than] help. Your power points matched lessons wonderfully.	True math to the Teacher's Manual
I really loved having the student questions on the slides. Turn to a partner, tell what you did/saw.	Student questions readily available
The visuals because not only did they aide in the instruction but made for easier classroom management to not need to get so many manipulates out.	Visual representations of content
There were times that explaining content or knowing the expectation was challenging but having the visuals was a huge help.	Visual representation of content/Teacher Learning
This resource was best used for my planning and lesson plan development/evaluation; teaching kindergartens requires a different skill set	Lesson planning
Yes, I found value in using the PowerPoint presentations. The biggest value to me was helping me prep each lesson. This is my first year using Eureka in kindergarten. Before planning each lesson, I looked at the PowerPoint presentations to figure out the lesson content and the lesson flow. Then I would read the manual to make sure I understand all the lesson.	Preparation
Yes! The most valuable aspect of the digital presentations was the student engagement they created.	Student Engagement
Yes!!! The most valuable aspect would probably be the time saved in lesson planning. However, a close second would be the lesson pacing and student engagement.	Time, pacing, student engagement

Summary

This chapter summarized and presented the data and data analysis including descriptive statistics, Cronbach's alpha reliability analysis, and paired-samples *t*-test to address the two research questions. The purpose of this mixed methods action research study was to identify how teachers describe the impact that pre-made digital slide share presentations (i.e., PowerPoint presentations) have on lesson planning, preparation, and pacing and to determine what impact translating teacher's manuals into digital slide share presentations (i.e., PowerPoint presentations) has on teacher's pedagogical content knowledge.

The analysis of the quantitative survey data for research question one, "How do teachers describe the impact that pre-made digital slide share presentations (i.e., PowerPoint presentations) have on lesson planning, preparation, and pacing?", resulted in no statistically significant results. However the means for each construct increased with the greatest increase in Lesson Planning and the smallest in Lesson Pacing. Results of qualitative data analysis indicated that teacher-participants described the impact of using the PowerPoint presentations as valuable.

For research question two, "What impact does translating teacher's manuals into digital slide share presentations (i.e., PowerPoint presentations) have on teacher's pedagogical content knowledge?" quantitative data analysis found the means for both constructs (PCK-Understanding and PCK-Performance) increased from pre-intervention to post-intervention, but only found statistically significant results for the PCK-Performance. Qualitative data analysis found that teacher-participants perceived improvement in both constructs and indicated there was an improvement in their ability to teach the Engage NY math content after using the presentations provided in the intervention of this study.

Next, Chapter Five summarizes the results of the study and provides insights and lessons learned as well as suggestions for future research.

Chapter 5

Discussion

The purpose of this action research study was to examine how teachers would describe the impact of digital presentations to their lesson planning, preparation, and pacing as well as to investigate if teachers perceived improved pedagogical content knowledge as it related to the Engage NY math content. To begin, the integration of quantitative and qualitative data will be explored to determine how the different types of data complement one another. Next, results will be discussed as they relate to the literature. Following this section, results from this study will be discussed, followed by personal lessons learned, and then limitations of this study will be reviewed. Implications for practice and future research will be addressed, and finally, conclusions will be presented.

Integration of Quantitative and Qualitative Data

Researchers often use qualitative and quantitative material together as the integration of quantitative and qualitative data "…allows for a more complete picture of the phenomena being studied versus the partial accounts applying solely a qualitative or quantitative method provides…" (Gelo, Braakmann, & Benetka, 2008). This study sought to determine if the teacher-participants found value in the use of digital presentations, specifically in pre-made PowerPoint presentations to use when teaching Engage NY math curriculum. Although this is something that can be quantified and counted, investigating why participants felt the way they do allowed me to determine if this educative curriculum material might be of use to a larger audience of teachers. Together, the qualitative and quantitative data were used to "…complement one method with another…" (Johnson & Onwuegbuzie, 2004, p. 15) and provide a more comprehensive understanding of how teachers describe the impact and value of using digital presentations in their classrooms.

Discussion of Results

Davis et al. (2014) argued that educative curriculum materials can help teachers "…acquire new ideas and develop teachers' content knowledge for teaching" (p. 26). This research study supports that claim in that teacher's reported increased content knowledge and improvement in their ability to relay content to students in a variety of ways. Participants expressed that the Engage NY math content was easier to explain with the use of the PowerPoint presentations and their interview responses indicated they felt more confident in not only presenting the content to students, but also explaining it to their peers. This study has also demonstrated that, at least for its' participants, PowerPoint presentations can and do serve as educative curriculum materials as defined by previous research literature.

The "educative features" taken from the teacher's manuals and incorporated into the digital presentations specifically supported teacher learning (Davis et al., 2017) while providing specific information that explained the underlying rationales and choices of those who developed the materials for the teacher. The presentations were able to guide teachers through the lessons and address common implementation issues (Schneider et al., 1999; Cervetti et al., 2015). Although teacher's manuals generally include these features throughout lessons, research has found that teachers often do not read the manuals well enough to absorb those details (Collopy, 2003; Land et al., 2015; Miller & Paget, 2016).

Participant I stated that using the presentations allowed her to give enough wait time for the students and found that they provided "…more direction and time to talk than I do." While the teacher's manual includes a suggested wait time in each lesson, it was not being given, and the lesson was not being presented as intended by the curriculum designers. After teaching the lesson several times, teachers may naturally learn to pause and let students reflect; however, that understanding comes from experience, not only in the classroom, but with exposure to the material as well. With the rate that teachers are leaving the profession, there simply is not time to acquire these skills and become proficient (Berliner, 2004). The educative features peppered throughout the lessons are vital components that contribute to the development of a teacher's pedagogical content knowledge (PCK). The PowerPoint presentations used in the intervention for this study served as educative curriculum materials because they supported teacher learning not only with content presentation, but in non-subject specific ways, including organization and depiction of pedagogy (Land et al., 2015). If a teacher's understanding of how students best learn the content (PCK) can be improved by simply adding educative features to digital presentations, it helps them to hone their craft that much faster.

Effective teaching with digital presentations such as PowerPoint can help to create connections between content and pedagogy, and requires a combination of content knowledge, understanding of how to represent concepts with technologies, pedagogical techniques that use technologies in constructive ways, knowledge of how students learn, and how technology can help (Baran, Chuang, & Thompson, 2001; Mishra & Koehler, 2008). Graham and Cox (2009) assert that knowledge of *how* to use PowerPoint presentations to facilitate student learning constitutes TPACK and that by choosing PowerPoint as the preferred tool to present specific content, educators are engaging in pedagogical strategies that they know work for teaching a particular topic "…rather than taking a generic approach that happens to include presenting content digitally" (Cox & Graham, 2009, p. 67).

Some teachers are not as confident integrating technology, even something as simple as PowerPoint, into lessons and may be more familiar working with older instructional aids such as chalkboards, pencils, and overhead projectors (Borko, Whitcomb, & Liston, 2009). Ertmer and Ottenbreit-Leftwich (2013) maintain that efforts should focus on teacher's pedagogical knowledge and how they can be supported in their practice to ensure seamless technology integration. Teachers need guidance and support to be able to use these tools efficiently in the classroom. Unfortunately, professional development given to teachers typically does not address their needs. In fact, none of the participants in this study had received any type of professional development for creating digital presentations. While adding digital presentations alone may not improve teaching and learning, teachers should understand how and when to integrate them into their classroom routine to support learning goals (Ertmer & Ottenbreit-Leftwich, 2013).

Personal Lessons Learned

As I examined the lessons learned in my action research project, I realized how much future decisions will be affected by the experiences I have had in the doctoral program. Several lessons were learned throughout the implementation of this study, and many of those lessons were learned the hard way. When I entered the doctoral program in 2016, I understood action research as I completed a smaller action research project for my master's degree in 2013. Initially, I intended to study technology use in the classroom; however, due to a change in personal circumstance, I began working in a setting that did not utilize technology in any way. I struggled to find a topic at this point in my journey and was about to give up. Instead, I took some time and reflected on my situation, and finally realized that I had a perfect opportunity to investigate the effects my PowerPoint presentations might have on other teachers who use the Engage NY math curriculum.

The goal of this action research then became to reflect on my own professional challenges and determine if I could support other teachers who felt the same and to examine if they found the pre-made PowerPoint presentations as helpful as I did. I witnessed the benefits of using pre-made lessons during my employment in corporate America, and I wanted to take that experience and apply it to my new realm in education. I hoped to alleviate some of the stress other teachers felt as they tried to plan lessons, as well as to return some of their most precious time to them. Initially, I was unsure if I was alone in my appreciation of pre-made digital presentations and considered that my previous colleagues may have told me that they enjoyed using my presentations to spare my feelings. Finding the Facebook group was serendipitous. Not only could I help teachers, but I would be able to present the presentations to a group of people who had no emotional attachment to me, nor I to them. Aside from the bond of being a teacher, I have no connection to the participants in the study in any way. We are not tied together geographically, or by any other social connections. I truly feel like this was a representative sample, even if it was a very specific, small sample.

I also learned the value of a well-constructed survey instrument. When I created the survey, I thought the questions I included would appropriately and completely answer my research questions. However, once I began analyzing the data, I realized that some of the questions could have been phrased differently to ensure that I was explicitly addressing the research questions. I am glad that I completed a mixed-methods action research project, as the qualitative data was incredibly helpful for filling in information that was missing from my survey results. Any additional research I complete in the future will include a more detailed investigation of the validity and reliability of any survey instrument I create.

One of the most profound lessons learned is that I am not alone. There are several teachers who also appreciate having a pre-made presentation available for guiding their lecture. Those teachers acknowledge the time the presentations saved them and recognize that the presentations not only helped their student's learning, but it benefitted their learning as well. I have always considered myself a reflective practitioner in all my endeavors, but when I look back on this doctoral program the process of conducting cycles of action research will forever change my professional practice. The most compelling aspect of action research is the ability to implement change in your own environment.

Limitations

Typically, the purpose of research is "…to use data to draw conclusions about the people on whom the data were collected" (Fraenkel & Wallen, 2009, p. 148). To prevent inaccurate conclusions from being drawn based on the data collected, researchers must consider and address any limitations that would constrain the generalizability of their findings. One limitation of this study was the small sample size. While each participant was a current classroom teacher, those who were interested and volunteered for the study may not be representative of the general population of teachers. Observation of the participants was not possible due to geographical separation, limiting data collection opportunities. The main source of data was self-reported observations and reflections. Teacher participants may or may not have been aware of their own biases when reporting their experiences and reactions to the intervention; therefore, outside factors could have influenced the participant's evaluation (positively or negatively). Conclusions drawn from this study truly represents only its participants and may not be transferrable to other teachers.

Another limitation of the study could be the specific format and type of educative curriculum material that was implemented and studied here. Critics of PowerPoint argue that it "…can be useful when one-way communication is appropriate, such as when presenting the results of an analysis or in a convention with a large audience…[but] it discourages active discussion and collaboration…" (Kernbach, Bresciani, & Eppler, 2015, p. 308). Furthermore, teachers may begin to rely solely on the presentations and not add their own personal insights to lectures. No one wants to be read to from a PowerPoint presentation, not even children in elementary school. If the use of the presentations was mandated, districts may insist on 100% compliance, evolving into a "scripted curriculum" that might make novice teachers feel complacent and believe the slides are exhaustive, including everything they need, and may limit veteran teachers' ability to adjust content appropriately based on their classroom experience.

Implications for Practice

Outcomes from the study suggest several implications for practice. By its very nature, this study was limited in scope and scale and the underlying topic is certainly open to additional exploration. The next section will discuss how the results from this study could affect the way in which teachers present content and how they themselves, continue learning in their classrooms. It will also address the role that educational researchers could play in alleviating this burden for teachers.

Measuring PCK is common for evaluating teacher pedagogy but is difficult because there is no single established approach to measure the concept. PCK is complex, and researchers must consider many data sources to create an accurate assessment of any classroom interaction (Morrison & Luttenegger, 2015). The instruments used in previous studies focused on teacher's content knowledge or their pedagogical knowledge; none focused on teacher's perceptions of their own PCK. The instrument created for this study could help guide future studies that seek to measure participant's perceptions of their own pedagogical content knowledge.

As the participants in this study were located across the United States, and we could not meet in person, it may have been beneficial to present to the teacher-participants via video conference to review how the PowerPoint presentations could be used in their classrooms. However, this study has shown that teachers will use teacher's guides if presented in a format that is user-friendly and complete. While past research found that teachers may not use the teacher's guides provided to them by their school or district because the guides tend to be difficult to navigate, awkward, and time consuming to use (Miller & Paget, 2016), this study demonstrated that teachers are not averse to using the teachers' guides if they are presented in a format that is easy to use. Prior studies determined that the use of these guides can scaffold teachers' learning by providing descriptions of classroom interactions which help teachers develop a better understanding of how students learn (Ball & Feiman-Nemser, 1988; Remillard, 2000). Consequently, it is worthwhile to find a format that teachers can and will use with minimal training. This study has shown that translating the material into an easy-to-use digital format may be a viable solution that would allow teachers to access the material more frequently and with increased fidelity.

If teachers will use provided curriculum materials with increased fidelity, then they should be provided with said materials and not be required to create them. Educational publishers should include these presentations with their boxed curriculum that is purchased by most school districts. These packaged curriculums are cumbersome, overwhelming and often ignored due to time constraints. Ensuring that teachers have straightforward access to their resources would benefit not only teachers, but also educational publishers. Creating educative curriculum materials in the form of easy-to-digest digital presentations will only help improve the effectiveness of the curriculum as it can increase the fidelity with which teacher's implement the programs. These presentations must include the educative features that are already provided in teacher's manuals to ensure that teachers have access to the pedagogical strategies that have been tested by the publisher or creator of the content. By doing so, teachers can continue to learn and grow along with their students.

Implications for Future Research

Results from this study also indicate there are several areas for further investigation. In the next section, these areas will be explored and recommendations for future cycles of action research will be made.

As previously mentioned, teachers today are often required to integrate digital technology into their classroom lessons. To do so, they need to understand which tools may best represent the concepts they are teaching. The TPACK framework offers an interpretation of how technology, content, and pedagogy work together as separate types of knowledge to improve student's learning (Mishra and Koehler, 2008). The PowerPoint presentations in this study were designed to offer teachers a user-friendly technological tool to simultaneously assist them with incorporating technology into their lessons and improve their pedagogical content knowledge.

Future cycles of action research could explore if the use of different kinds of media would improve teacher's perceptions of the use of digital presentations in the classroom. For example, many classrooms today have interactive whiteboards. This type of technology allows for teachers and students to interact with the content instead of simply receiving the information as is typical in a PowerPoint presentation. With the added ability to manipulate data on the screen, would teachers find more value in interactive presentations? A challenge would be creating presentations that would be accessible to all classrooms. As many of the interactive white boards use brand-specific software, creating presentations that are accessible to all teachers could become an overwhelming challenge for one teacher-creator. At that point, I would suggest that this concept be presented to educational publishers who can create these products and include them in the curriculum packages they sell to school districts.

While the presentations used in this study offered a solid introduction to using technology in the classroom, there are several ways to integrate other kinds of technological components into the PowerPoint presentations. Adding interactive polls, surveys and open ended questions are great ways to increase student engagement and allow them to interact with the content and be an active participant in the lesson. I have heard from a few teachers who teach in one-to-one classrooms, where every student has their own device (computer, iPad, etc.), that they have imported the lessons into Nearpod©, which is a web-based app that allows teachers to add polls and surveys directly to the lesson. Additionally, teachers do not have to worry about students not being able to see their board as every student has the presentation in front of them. The app offers many more features and allows students to engage with the presentations in their own time as they can watch the lesson again at home. There are many applications like Nearpod© that would allow teachers to make small, specific changes to the presentations to ensure the needs of their students were being met.

One participant found a creative way to reach her students based on their learning styles and abilities. Participant I indicated that she used the presentations in a "flipped learning" type of environment. She noted:

> For my highest students, I would set up the power point as a flipped classroom. They would work thru the slides either independently or with a partner while I was working one on one with students who needed more support. This allowed for everyone to be successful. The students loved being in control of how fast they

worked and the independence they were given. This to me was the best part of having the slides.

The presentations could easily be altered in several ways so that they better meet the needs of all kinds of learners. Students receiving special education services could have the presentations broken down into components that would suit their learning needs and styles. For students who struggle with reading, an audio component could be added. Additionally, ELL (English Language Learner) students could have access to the content in their native language and for bilingual studies, the teachers would have the content prepared for them. PowerPoint presentations give teachers an opportunity to utilize a well-known form of digital technology and through repeated daily interactions, teachers and students will become more familiar with and comfortable using a digital component in their lessons. To utilize the technology to provide the greatest benefit, teachers should understand how technology and content influence and constrain one another. The components of the TPACK framework could guide content creators and help them make the content more accessible so that it meets every student's individual needs.

Future cycles of this action research study could investigate if teachers that feel they benefit from the use of the PowerPoint presentations are represented by one specific demographic. The teachers that completed this study were more tenured than others who did not complete the pre-intervention and post-interventions and the interviews. Several of the participants that left the study were first year teachers. Because the teachers who remained in the study had on average 15 years of classroom experience, it would be interesting to investigate why they found value in the use of the presentations. It would also be worth exploring if new teachers would benefit from the use of the presentations if they were given formal training in a professional development session. Either way, it would be worthwhile to explore why more tenured teachers found the presentations to be helpful. It is entirely possible that because they had no classroom experience, the newer teacher's focus was on surviving their first year in the classroom and therefore, use of the presentations was a very low priority. Therefore, I would add a professional development component in any future iterations of this research. While I did not send out any official communication to participants that dropped out, I did have one new teacher reach out to me and advise that she was completely overwhelmed with all her other responsibilities and would not be able to continue in the study. As the entire purpose of the presentations is to help relieve some of the teacher's burdens, I think it would be beneficial to have a webinar or some sort of standardized training available to ensure that participants are aware of the presentation's features and understand how to use them.

Future cycles of this action research study could include a measure of student progress in classes where teachers consistently used the presentations. Participant J offered the following insight:

> I believe the PowerPoints aided my student's learning. Module 1, I started with 5 students at grade level and ended with all 15 at grade level. Whereas another teacher teaching the same material without the PowerPoints ended with only 6 students at grade level and all those students were at grade level during the pre-assessment.

While this teacher-participant attributed her students' success in part to the presentations, several factors could have caused her group to be more successful than the other teacher's group. I would recommend a true experimental design with random assignment of the intervention to further investigate the claim of student success as a direct result of using the presentations.

My last recommendation for a future cycle of action research would be to measure teacher's mathematical content knowledge to determine if there was a definable improvement in content knowledge after using the presentations to teach. As this study sought to investigate if teachers felt there was an improvement, it was measuring perception. A true measure of improvement in mathematical content knowledge would need to be determined by a pre-intervention and post-intervention math exam and teachers of varying levels of experience would be required to truly represent the overall population. While this study sought to gather information from current educators about their practices utilizing PowerPoint, future iterations of this study could explore changes in teacher attitudes and behaviors as they utilize pre-made PowerPoint presentations. Additionally, it would be beneficial to determine if this presentation format could work for other content areas throughout various grade levels.

Conclusion

Based on the results from this study, I remain convinced that many teachers could benefit from the use of PowerPoint presentations in their classrooms. The teachers interviewed in this study have years of experience in the classroom, but they still believed that using pre-made PowerPoint presentations improved their lesson planning, preparation, and pacing. Inoue-Smith (2016) notes that as PowerPoint has become an integral part of teaching, educators need "…to rethink the ways in which PowerPoint presentations are delivered to ensure their effectiveness" (p. 4). However, teachers' personal epistemological outlooks have a discernable influence on how they educate their students. Their beliefs about the nature of knowledge and how best to help people acquire that knowledge play a fundamental role in how teachers teach, including the tools they chose to present content. Presentations should help teachers present the content in a meaningful way for both themselves and their students. PowerPoint is a simple tool that can easily be used to support educators in creating and/or delivering content. If teachers are less consumed with creating content, they will have more time to evaluate what they are presenting and ensure the curriculum student mastery and achievement (Snider & Gershner, 1999).

The general impression I took from this study is that it seems that what teachers need most is more time. With additional time, teachers can focus their energy on other matters that are currently being neglected. Perhaps they will focus on differentiating lessons to meet the needs of individual learners or addressing the social-emotional needs of the classroom community. Although I can easily see where additional time may be spent and find other avenues to pursue further academically, I continue to struggle with the idea that a study such as this one is even relevant. I still do not fully grasp why the expectation is that each teacher will create brand new resources for every class, in every content area. Teachers cannot be expected to be subject matter experts on everything. I believe this impractical expectation plays a large part in teacher job dissatisfaction. When teachers are being evaluated based on their ability to know all, see all, and do all, they are bound to fail. Why are we setting our teachers up to fail? Offering a small piece of support, as simple as a pre-made PowerPoint lesson that allows them to learn along with their students, is an easy and simple solution that could be implemented immediately.

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APPENDIX A

TEACHERS MANUAL KINDERGARTEN GRADE MODULE 3 LESSON 12

Lesson 12

Objective: Compare the weight of an object with sets of different objects on a balance scale.

Suggested Lesson Structure

Fluency Practice	(12 minutes)
Application Problem	(5 minutes)
Concept Development	(27 minutes)
Student Debrief	(6 minutes)
Total Time	**(50 minutes)**

Fluency Practice (12 minutes)

- 5-Group Hands K.CC.2 (3 minutes)
- Roll and Draw 5-Groups K.OA.3 (5 minutes)
- Hidden Numbers on the Dot Path K.OA.3 (4 minutes)

5-Group Hands (3 minutes)

Materials: (T) 5-group cards in vertical orientation (Lesson 5 Fluency Template 1)

Note: This maintenance activity develops flexibility in seeing the 5-groups vertically or horizontally and adds a kinesthetic component.

Conduct as described in Lesson 5, showing the 5-group cards in the vertical orientation. Accordingly, students should put their hands side by side to represent the number.

Roll and Draw 5-Groups (5 minutes)

Materials: (S) Die (with the 6-dot side covered), personal white board

Note: Observe to see which students erase completely and begin each time from one, rather than draw more or erase some to adjust to the new number. By drawing 5-groups, students see numbers as having length in relationship to the five.

Conduct as outlined in Lesson 7. Consider alternating between drawing the 5-groups vertically and drawing them horizontally.

Hidden Numbers on the Dot Path (4 minutes)

Materials: (S) Dot path (Lesson 5 Fluency Template 2) inserted into personal white board

Note: Finding embedded numbers anticipates the work of Module 4 by developing part–whole thinking.

T: Fold your dot path so that you can see only 6 dots. Place it inside your personal white board. How many dots can you see?
S: 6.
T: Circle 2 of them.
S: (Circle the first 2 dots.)
T: See how many twos you can circle on your dot path.
S: (Circle 3 sets of 2 dots.)
T: How many dots are on the whole dot path?
S: 6.
T: How many twos did you find hiding within the 6?
S: 3.

Continue the process with finding groups of 3 within the 6. Guide students to find a group of 4 or 5 and then tell what number of dots remains.

Application Problem (5 minutes)

MP.6

Find one small item in your backpack. Put it on the balance scale. How many pennies do you think it will take to balance your object? Use pennies to test your guess. Make a picture of the balance with your object and the pennies. Finish this sentence, "My item is as heavy as a set of ___ pennies."

What do you think would happen if you put another penny on each side of the balance scale? Test your guess!

Note: The review of use of the balance to find objects of equal weight serves as the anticipatory set for today's lesson.

> **NOTES ON MULTIPLE MEANS OF ENGAGEMENT:**
> Challenge students working above grade level by asking them to explain why they think the balance scale remains evenly balanced even as they place an extra penny or more on each side.

Concept Development (27 minutes)

Materials: (T) Simple balance scale, marker, 2 pennies, small bag of linking cubes, small counters, beans, and as heavy as a set recording sheet (Template) (S) 1 simple balance scale per pair or small group of students, 4 small bags of various items to use as weights (pennies, linking cubes, small counters, and large dried beans), collection of classroom objects for the balance exercise, and as heavy as a set recording sheet (Template)

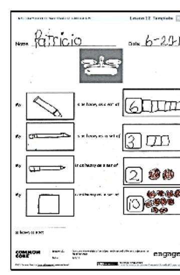
T: Look carefully at my balance. Now, watch as I put my marker on one side. Do you remember how I weighed my marker yesterday?
S: You used pennies.

T: Let's try that again. I have a set of 2 pennies. Watch and see if the scale balances.
S: 1 penny... 2 pennies... It is not enough! The marker is too heavy.
T: My marker is heavier than a set of 2 pennies. I don't have any more pennies. What should I do?
S: (Various comments.)
T: Look at the other items on the table. Is there another way to see how heavy the marker is?
S: What if we used cubes?
T: Could I use my two pennies and a cube?
S: No! That wouldn't be fair. → The cubes and the pennies aren't the same. → You shouldn't count them all together.
T: I'll take the pennies off and use a tower of cubes. Help me count how many cubes would be in a tower as heavy as my marker.
S: 1, 2, 3, 4, 5, 6. 6 cubes.
T: My marker is as heavy as a tower of 6 cubes. Let me put that on the recording sheet. I will draw the marker and the cubes, and I will write how many cubes in the box. (Demonstrate.)
T: What else could I use?
S: Try the beans!
T: I will take off the cubes and use a set of beans this time. I wonder how many beans it will take to balance my marker. (Various responses.) Count with me. (Repeat the experiment and recording with beans and small counters.)
T: Wow! Look what we've discovered. (Point to the sheet.) My marker is as heavy as a tower of 6 cubes. My marker is as heavy as a set of 10 beans. My marker is as heavy as a set of 4 counters. Why are all the numbers different?
S: The things are all different! → Because the cubes are bigger than the beans. → Because the counters are heavier.
T: You and your partner can try this, too. Choose one object from your bag. Count how many pennies are as heavy as your object, and record it on your sheet. Then, count how many cubes are as heavy as the object. Do the same thing with the beans and the counters. Don't forget to guess before you test! (Allow time for experimenting and recording. Circulate to make sure that the only variation is in the unit of measurement.)
T: Put your things away. Who would like to share his or her recording sheet with our class? What did you discover?

> **NOTES ON MULTIPLE MEANS OF ENGAGEMENT:**
> Scaffold the activity for English language learners by providing sentence frames such as, "I think my [object] is [number] pennies heavy." Listen as they use the sentence frames during their partner work, and encourage them.

Problem Set (10 minutes)

In this lesson, the as heavy as a set recording sheet will serve as the Problem Set for the lesson.



Student Debrief (6 minutes)

Lesson Objective: Compare the weight of an object with sets of different objects on a balance scale.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their recording sheets. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Student Debrief. Guide students in a conversation to process the lesson.

Any combination of the questions below may be used to lead the discussion.

- Did you notice any patterns as you were balancing your object with sets of different things?
- Which set of things was the biggest? Which set was the smallest?
- Why were all of the sets different sizes?
- Compare your recording sheet with your friends'. Did you find the same answers?
- What math vocabulary did we use today to communicate precisely?

APPENDIX B

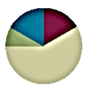
TEACHERS MANUAL 1ST GRADE MODULE 6 LESSON 11

Lesson 11

Objective: Add a multiple of 10 to any two-digit number within 100.

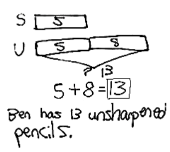
Suggested Lesson Structure

Application Problem	(5 minutes)
Fluency Practice	(10 minutes)
Concept Development	(35 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**



Application Problem (5 minutes)

Ben sharpened 5 pencils. He has 8 more unsharpened pencils than sharpened pencils. How many unsharpened pencils does Ben have?



Note: Today's *comparison with bigger unknown* poses the additional challenge that there is only one person in the story. If students are still struggling with comparison problem types, consider altering the problem so that two students' pencils are being compared. Have a brief student discussion of the solution before moving on to the Fluency Practice.

Fluency Practice (10 minutes)

- Core Fluency Differentiated Practice Sets **1.OA.6** (5 minutes)
- Coin Drop **1.NBT.5, 1.MD.3** (3 minutes)
- Get to the Next Ten **1.NBT.4** (2 minutes)

Core Fluency Differentiated Practice Sets (5 minutes)

Materials: (S) Core Fluency Practice Sets (Lesson 1)

Note: Give the appropriate Practice Set to each student. Help students become aware of their improvement. After students do today's Practice Sets, ask them to stand if they tried a new level today or improved their score from the previous day. Consider having students clap once for each person standing to celebrate improvement.

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Students complete as many problems as they can in 90 seconds. Assign a counting pattern and start number for early finishers, or have them practice make ten addition or subtraction on the back of their papers. Collect and correct any Practice Sets completed within the allotted time.

Coin Drop (3 minutes)

Materials: (T) 10 dimes, 10 pennies, can

Note: This activity reviews yesterday's lesson (Lesson 10), where students added and subtracted tens within 100.

Repeat the process from Lesson 5. Now that students have learned to add and subtract multiples of 10 from multiples of 10, the teacher may take out more than one dime at a time and have students calculate the remaining dimes.

Get to the Next Ten (2 minutes)

Note: This fluency activity builds on Lesson 10's Get to Ten(s) activity to prepare students for Lesson 13.

Say a number. Students say an addition sentence to get to the next multiple of 10. For the first few problems, begin with a number from 0 to 9 to provide students with a helper problem on which to build. Then, say numbers without providing the helper problem.

T: Say the addition sentence to get to the next ten. 9.
S: 9 + 1 = 10.
T: 59.
S: 59 + 1 = 60.

Continue with the following suggested sequence: 5, 65; 8, 78; 7, 87; and 6, 96.

Concept Development (35 minutes)

Materials: (T) 100-bead Rekenrek (S) Personal white board

Have students gather in the meeting area in a semicircle formation with their materials.

T: (Write 40 + 30 = ? on chart paper.) On your personal white board, write the number sentence, and replace the question mark with the missing number. (Wait as students complete the task.)
T: 40 + 30 is…?
S: 70.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

At this point in the year, students should be able to add a multiple of ten to any multiple of 10 within 100. If some students are struggling, have them use linking cubes in ten-sticks or quick ten drawings for more concrete or pictorial supports. Use the language of place value so that the dialogue begins to become part of their independent thinking. Work toward solving without the concrete supports.

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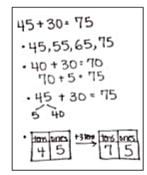
T: Explain how you know that 40 + 30 equals 70. You can draw or write on the chart paper to explain your thinking.
S: If you use the Rekenrek, you slide 4 tens over and then 3 tens over, and that's 7 tens, or 70. → Four tens plus 3 tens is 7 tens. That's 70. → In the place value chart, you add 3 tens to the 4 tens you have. (Post or show yesterday's chart paper, if available. Draw the place value chart and the number bond on today's chart paper.)
T: (Draw a line to start a new section of the chart paper. Write 45 + 30 = ? Move over 45 beads on the 100-bead Rekenrek.) On your personal white board, write this number sentence, and replace the question mark with the solution.
T: (Wait as students complete the task. If students do not know the answer right away, provide more time for them to remember solution strategies, e.g., quick ten drawings, the Rekenrek, counting on, decomposing, and composing).
T: 45 + 30 is…?
S: 75.

MP.3

T: Who would like to share how they solved 45 + 30? Listen to your friends' ideas, and be ready to ask questions or comment. (As students are explaining, record their examples on the chart using number bonds and place value charts.)
S: On the Rekenrek, there are 4 rows and 3 rows and 5 extra beads, so that's 7 tens and 5 ones, which is 75.
T: Does anyone have a question or comment about the Rekenrek solution?
S: Why did you say row? The five extras are a row, too.
S: Because I meant a row of ten. I guess I should say a full row.
T: Did anyone solve 45 + 30 in a different way?
S: I started at 45 and counted on ten 3 times. 45, 55, 65, 75.
T: Does anyone have a question or comment about the counting on solution?
S: Could you start counting on from 30?
S: Sure, I guess so. 30, 40, 50, 60, 70, 75. It's just easier for me the other way.
T: Did anyone solve 45 + 30 in a different way?
S: I broke 45 into 40 and 5 with the number bond, and then I added 40 and 30 first, which is 70, and then added on 5 to make 75.
T: Are there questions or comments about the number bond solution?
S: That's easy for me. I like that better than my way.
T: Why?
S: Because it's like I could just see it better. I counted on, and it seemed slower, too.



NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Some students may get confused with all of the strategies available to them for solving problems. As the teacher, it might help these students to include one consistent method for solving. Then, students can share alternative strategies to allow exposure, but consistency really helps students who are struggling.

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MP.3

T: Did anyone solve 45 + 30 in a different way?
S: I thought of the place value chart and just added 3 tens to 4 tens and left the 5 ones alone. That gave me 75.
T: Are there comments and questions about the place value chart solution?
S: I don't understand what you mean that you left the 5 ones alone.
S: I mean when I was adding the tens, the ones didn't change.
T: It is important to really listen to your friends' solution strategies so that you can comment and ask questions.

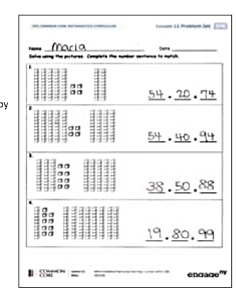
Provide time for students to solve the following suggested sequence of problems. Students who would benefit from more concrete or pictorial support may use linking cubes in ten-sticks and ones, dimes and pennies, or quick ten drawings.

- 51 + 40
- 24 + 60
- 50 + 38
- 62 cents + 3 dimes
- 8 dimes + 12 cents
- 63 + _____ = 93
- 14 + _____ = 74
- _____ + 39 = 59
- _____ + 40 = 98

After each problem, have one or two students share a different method for solving the problem.

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.



Student Debrief (10 minutes)

Lesson Objective: Add a multiple of 10 to any two-digit number within 100.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

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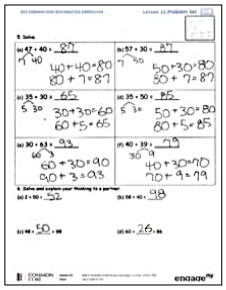
Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.


5. Solve.

(a) 47 + 40 = 87 7 40 40 + 40 = 80 80 + 7 = 87	(b) 57 + 30 = 87 7 50 50 + 30 = 80 80 + 7 = 87
(c) 35 + 30 = 65 5 30 30 + 30 = 60 60 + 5 = 65	(d) 35 + 50 = 85 5 30 50 + 30 = 80 80 + 5 = 85
(e) 30 + 63 = 93 60 3 60 + 30 = 90 90 + 3 = 93	(f) 40 + 39 = 79 30 9 40 + 30 = 70 70 + 9 = 79

6. Solve and explain your thinking to a partner.

(a) 2 + 50 = 52 (b) 58 + 40 = 98

(c) 48 + 50 = 98 (d) 60 + 26 = 86

Any combination of the questions below may be used to lead the discussion.

- Look at Problem 5 (c) and (d). How could solving Problem 5(c) help you solve Problem 5(d)?
- Look at Problem 6 (a) and (b). Did you or your partner use a different strategy than the number bond work from the top of the page? If so, explain your strategy.
- Look at Problem 6 (c) and (d). How did you find the missing addends? Explain your thinking.
- How is today's work similar to and different from yesterday's work?
- How did the coin drop fluency activity help you get better at adding tens?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

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5. Solve.

a. 47 + 40 = ______	b. 57 + 30 = ______
c. 35 + 30 = ______	d. 35 + 50 = ______
e. 30 + 63 = ______	f. 40 + 39 = ______

6. Solve and explain your thinking to a partner.

a. 2 + 50 = _____ b. 58 + 40 = _____

c. 48 + _____ = 98 d. 60 + _____ = 86

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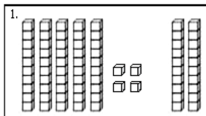
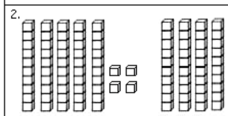
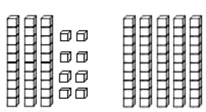
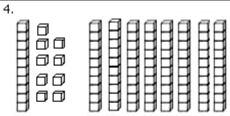
Name ______________________ Date ____________

Solve using the pictures. Complete the number sentence to match.

1.

_____ + _____ = _____

2.

_____ + _____ = _____

3.

_____ + _____ = _____

4.

_____ + _____ = _____

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Name ______________________ Date ____________

Solve. Use quick tens and ones drawings or number bonds.

a. 42 + 50 = ______	b. 30 + 57 = ______

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APPENDIX C

TEACHERS MANUAL 2^{ND} GRADE MODULE 4 LESSON 12

Lesson 12

Objective: Relate manipulative representations to a written method.

Suggested Lesson Structure

Fluency Practice	(11 minutes)
Application Problem	(5 minutes)
Concept Development	(34 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**

Fluency Practice (11 minutes)

- Using 10 to Subtract **2.NBT.5** (3 minutes)
- Get the Ten Out to Subtract **2.NBT.5** (5 minutes)
- How Many More Tens **2.NBT.5** (3 minutes)

Using 10 to Subtract (3 minutes)

Repeat the fluency activity from Lesson 11.

Get the Ten Out to Subtract (5 minutes)

Note: Students practice taking out the ten and subtracting to prepare for unbundling a ten in today's lesson.

T: For every number sentence I give, subtract the ones from ten. When I say 12 – 4, you say 10 – 4 = 6. Ready?
T: 12 – 4.
S: 10 – 4 = 6.
T: 13 – 7.
S: 10 – 7 = 3.

Practice taking the ten out of number sentences fluently before adding the ones back.

T: Now let's add back the ones.
T: 12 – 4. Take from ten.
S: 10 – 4 = 6.
T: Now add back the ones.
S: 6 + 2 = 8.

Continue with the following possible sequence: 13 – 7, 11 – 8, 13 – 9, 15 – 7, and 14 – 8.

How Many More Tens? (3 minutes)

Materials: (S) Personal white board

Note: Practice adding and subtracting multiples of 10 prepares students for the lesson.

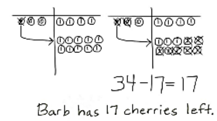
T: If I say 45 – 35, you say 10. To say how many more tens in a sentence, you say 45 is 10 more than 35. Ready?
T: 65 – 45.
S: 20.
T: Say it in a sentence.
S: 65 is 20 more than 45.

Continue with the following possible sequence: 85 – 45, 74 – 24, 59 – 29, 38 – 18, and 99 – 19.

Application Problem (5 minutes)

Barb has a bag of 34 cherries. She eats 17 cherries for a snack. How many cherries does she have left?

Note: This problem is designed for independent practice and serves to reinforce the concept of decomposing 1 ten as 10 ones with manipulatives. Allow students to use place value disks when solving. If students need support, guide them through the process of unbundling a ten with place value disks.



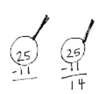
Concept Development (34 minutes)

Materials: (T) Place value disks (19 ones and 9 tens), unlabeled tens place value chart (Lesson 1 Template)
(S) Place value disks (19 ones and 9 tens), unlabeled tens place value chart (Lesson 1 Template), personal white board, place value disks (Lesson 6 Template)

Problem 1: 25 – 11

T: (Write 25 – 11 on the board.) Read this problem with me.
S: 25 minus 11. (Read the problem chorally.)
T: (Draw a blank number bond on the board.) What is the whole?
MP.2 S: 25.
T: What is the part that we know?
S: 11.
T: What do we need to find?
S: The missing part.

T: That's right. When we use place value disks to solve a subtraction problem, we only put the whole on our chart. Turn to your neighbor, and tell him or her why we only show the whole when subtracting.
S: You take away one part from the whole. → You are not adding two parts; you are taking away. → 11 is inside 25, and we are finding it and taking it out.
T: Count the total value of the disks as I place them. Say the units, too. 1 ten, 2 tens, 2 tens 1 one, 2 tens 2 ones, 2 tens 3 ones, 2 tens 4 ones, 2 tens 5 ones. (Place 2 tens 5 ones on your place value chart. Direct students to do the same.)
T: Today, as we solve subtraction problems, we are going to record our work in vertical form. (Write the problem in vertical form.)
T: What is the whole we are subtracting from?
S: 25.
T: We want to look carefully at the whole when subtracting, like a detective, to see if we need to do any unbundling. Let's draw an imaginary magnifying glass around 25. (Draw the magnifying glass as shown to the right.)

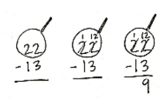


T: Let's start by looking at the smallest place value, the ones: Can we take 1 one disk from 5 ones disks?
S: Yes!
T: Let's move to the tens column. Can I take 1 ten from 2 tens?
MP.2 S: Yes!
T: We are ready to subtract because we have checked to make sure we have enough units in each place value.
T: Take 1 one from the 5 ones. (Remove 1 one from the place value chart. Students do the same.)
T: How many ones are left?
S: 4 ones.
T: (Record 4 in the ones column.) Take 1 ten from 2 tens. (Remove 1 ten from the place value chart, and record the answer in the answer space. Students do the same.)
T: What is 25 – 11?
S: 14.

Problem 2: 22 – 13

T: Let's try another problem together. This time I want you to record your answers vertically as I do. (Write 22 – 13 on the board in vertical form. Students do the same.)
T: What should I do first?
S: Find out if we need to unbundle.
T: (Draw the magnifying glass with enough space to write renaming, and instruct students do the same.)
T: Okay, I'm looking closely at it. Where do I start?
S: Start in the ones column. → Check to see if you can subtract the ones.

T: Can I subtract 3 ones from 2 ones?
S: No!
T: What should I do?
S: Decompose a ten.
T: (Change a ten for 10 ones. Arrange them in 5-groups on the place value chart. Instruct students to do the same.)
T: Whatever I do to my place value disks, I must also do to the numbers in vertical form. How should I record unbundling a ten?



S: Cross out the 2 in the tens place, and write 1 above it. Cross out the 2 in the ones place, and write 12 above it. → Change 2 tens to 1 ten and 2 ones to 12 ones.
T: Now how many tens and ones do you see on my place value chart?
S: 1 ten 12 ones.
MP.2 T: Can I subtract 3 ones now?
S: Yes!
T: Can I subtract 1 ten now?
S: Yes!
T: Then, we are ready to subtract! What are we?
S: Ready to subtract!
T: Then, let's subtract!
T: 12 ones minus 3 ones is...?
S: 9 ones.
T: 1 ten minus 1 ten is...?
S: 0 tens.
T: What is the answer to 22 – 13?
S: 9.

NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

Encourage students to use the place value disks for the Problem Set until they are comfortable enough with the process to use the vertical form alone. If a student is comfortable using the algorithm without the disks, allow him to work without them.

Repeat the process above with the following possible sequence: 31 – 18, 46 – 28, and 32 – 19.

Problem Set (10 minutes)

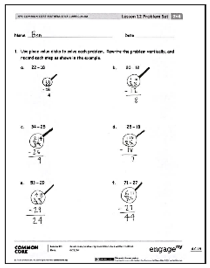
Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

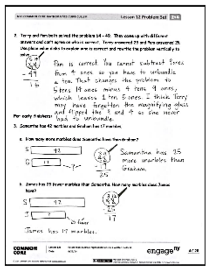
Student Debrief (10 minutes)

Lesson Objective: Relate manipulative representations to a written method.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.





Any combination of the questions below may be used to lead the discussion.

- How did unbundling a ten help you to solve Problem 1(b)?
- How did you solve Problem 1(c)? How did you use the place value disks on the chart to show decomposing a ten?
- Explain to your partner how you used place value disks to solve Problem 1(d). How did your work with the place value disks match the vertical form?
- How did you solve Problem 1(e) using place value disks and the vertical form? How could you have solved this problem differently using a simplifying strategy?
- For Problem 2, explain to your partner how you know who is correct, Terry or Pam?
- How does Problem 3(a) help us to solve Problem 3(b)?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Name ______________________ Date ____________

1. Use place value disks to solve each problem. Rewrite the problem vertically, and record each step as shown in the example.

a. 22 – 18

$$\begin{array}{r} 22 \\ -\ 18 \\ \hline 4 \end{array}$$

b. 20 – 12

c. 34 – 25

d. 25 – 18

e. 53 – 29

f. 71 – 27

2. Terry and Pam both solved the problem 64 – 49. They came up with different answers and cannot agree on who is correct. Terry answered 25, and Pam answered 15. Use place value disks to explain who is correct, and rewrite the problem vertically to solve.

For early finishers:

3. Samantha has 42 marbles, and Graham has 17 marbles.

a. How many more marbles does Samantha have than Graham?

b. James has 25 fewer marbles than Samantha. How many marbles does James have?

Name ______________________ Date ____________

Sherry made a mistake while subtracting. Explain her mistake.

Sherry's Work:	Explanation:
$\begin{array}{r} {}^{14} \\ 44 \\ \underline{-26} \\ 28 \end{array}$	

APPENDIX D

TEACHERS MANUAL 3RD GRADE MODULE 1 LESSON 12

Lesson 12

Objective: Apply the distributive property and the fact 9 = 10 – 1 as a strategy to multiply.

Suggested Lesson Structure

Fluency Practice	(11 minutes)
Application Problem	(6 minutes)
Concept Development	(33 minutes)
Student Debrief	(10 minutes)
Total Time	**(60 minutes)**

Fluency Practice (11 minutes)

- Multiply By 8 **3.OA.7** (7 minutes)
- Take from the Ten **3.OA.5** (4 minutes)

Multiply by 8 (7 minutes)

Materials: (S) Multiply By 8 (6–10) (Pattern Sheet)

Note: This activity builds fluency with respect to multiplication facts using units of 8. It supports students knowing from memory all products of two one-digit numbers. See Lesson 5 for the directions regarding administration of a Multiply By Pattern Sheet.

T: (Write 6 × 8 = ____.) Let's skip-count up by eights to solve. (Count with fingers to 6 as students count.)
S: 8, 16, 24, 32, 40, 48.
T: Let's skip-count down to find the answer, too. Start at 80. (Count down from 10 fingers as students count.)
S: 80, 72, 64, 56, 48.
T: Let's skip-count up again to find the answer, but this time start at 40. (Count up from 5 fingers as students count.)
S: 40, 48.

Continue with the following possible sequence: 8 × 8, 7 × 8, and 9 × 8.

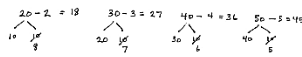
T: (Distribute the Multiply By 8 Pattern Sheet.) Let's practice multiplying by 8. Be sure to work left to right across the page.

Take from the Ten (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity prepares students for today's Concept Development.

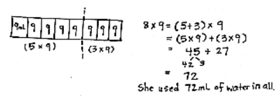
T: (Write 20 – 2 = ____.) Say the subtraction sentence in unit form.
S: 2 tens – 2 ones.
T: (Point to the 20.) Let's break apart the 20, taking out 10 ones. How many tens are left?
S: 1 ten.
T: What's 10 ones – 2 ones?
S: 8 ones.
T: (Write 8.)
T: What's 20 – 2?
S: 18.
T: (Write 20 – 2 = 18.)
T: (Write 30 – 3 = ____.) After writing the equation, break apart the 30, taking out 10 ones.
S: (Break apart the 30 into 20 and 10.)
T: Take 3 ones from 10 ones and complete the equation.
S: (Take 3 from 10 to get 7; 30 – 3 = 27.)



Continue with the following possible sequence: 40 – 4, 50 – 5, 60 – 6, 70 – 7, 80 – 8, and 90 – 9.

Application Problem (6 minutes)

A scientist fills 5 test tubes with 9 milliliters of fresh water in each. She fills another 3 test tubes with 9 milliliters of salt water in each. How many milliliters of water does she use in all? Use the break apart and distribute strategy to solve.

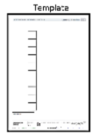


Note: The Application Problem is meant to reinforce the 5 + *n* break apart and distribute strategy to support Problem 1 in the Problem Set and also provide a point of comparison between the 5 + *n* strategy and 9 = 10 – 1 strategy for multiplying with a factor of 9. Notice that, to add 45 and 27, the student has taken 3 from 45 to make 30 from 27.

Concept Development (33 minutes)

Materials: (S) Personal white board, tape diagram (Template)

Template



Use the 9 = 10 – 1 strategy to solve 9 × *n* facts.

Have students insert templates into their personal white boards.

T: We solved 8 × 9 in the Application Problem. Does 8 × 9 show 8 units of 9 or 9 units of 8?
S: 8 units of 9.
T: What multiplication fact represents 9 units of 8?
S: 9 × 8.
T: How can our work solving 8 × 9 help us solve 9 × 8?
S: We can use the commutative property to know that, if 8 × 9 = 72, then so does 9 × 8.
T: Sometimes we can't use the commutative property because we don't know the product of either fact. Let's look at how we can use a tens fact to help solve a nines fact when that happens. What's easier to solve, 9 × 8 or 10 × 8?
S: 10 × 8 because we already know tens facts.
T: How many eights are in 10 × 8?
S: 10 eights!
T: Label them on your tape diagram.
T: How many eights in 9 × 8?
S: 9 eights!
T: Change your tape diagram so it shows 9 eights. (Allow students time to finish their work.)
T: What change did you make?
S: I crossed off an eight. → I took away 1 eight. → I subtracted one unit.
T: 9 eights (point to the tape diagram) equals 10 eights minus...?
S: 1 eight!
T: Work with your partner to write a number sentence showing that.
S: (Write 9 × 8 = (10 × 8) – (1 × 8).)
T: Rewrite your equation using the products of 10 × 8 and 1 × 8.
S: (Write 9 × 8 = 80 – 8.)
T: What is 80 – 8?
S: 72.
T: Tell your partner how we used a tens fact to solve a nines fact.
S: We just took the product of 10 × 8 and subtracted 1 eight. → That made the math simple. I can do 80 – 8 in my head!

NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:

Teachers should adjust their rate of speech for English language learners and others as students write equations in response to oral prompts. Label the equations. For example, write *9 eights* under *9 × 8*.

MP.3

T: (Write 9 × 8 = (5 + 4) × 8.) One way we've learned to solve 9 × 8 is by breaking 9 eights up into 5 eights plus 4 eights. Why did it work well to subtract this time instead?
S: Because we only had to subtract 1 eight. → Yeah, 9 is really close to 10, and tens are easy to use. We already know 10 × 8, and besides, it's easy to subtract from a tens fact.
T: Work with your partner to change the equation I just wrote for 9 × 8. Make sure it shows how we used subtraction to solve.
S: (Change the equation to 9 × 8 = (10 – 1) × 8.)
T: What part of the equation did you change?
S: We changed 5 + 4 to 10 – 1.
T: Why?
S: Because we didn't add; we subtracted. We started with 10 eights and then took away 1 eight.

Continue with the following suggested sequence: 9 × 7 and 9 × 6.

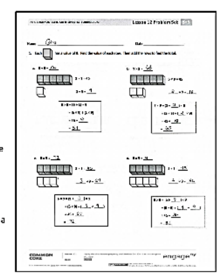
NOTES ON MULTIPLE MEANS OF ENGAGEMENT:

As students solve the Problem Set, some learners may solve Problem 1 more efficiently using the 9 = 10 – 1 strategy.

Students working above grade level can be encouraged to write equations using parentheses for Problem 2. Challenge students to offer multiple equations. Ask, "How many equations can you write for Problem 2(a)?"

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.



Student Debrief (10 minutes)

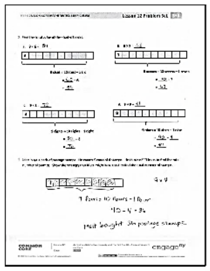
Lesson Objective: Apply the distributive property and the fact 9 = 10 – 1 as a strategy to multiply.

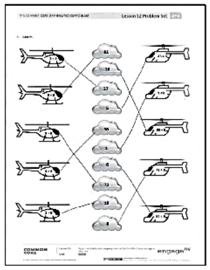
The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class. Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

Any combination of the questions below may be used to lead the discussion.

- What does the nine represent in Problem 1? (It represents the value of each unit.) What does the nine represent in Problem 2? (It represents the number of units.)
- How can multiplication be used to solve the division facts in Problem 4?
- Think about the strategy used to solve Problem 2(a). How could a similar strategy be used to solve 8 × 6 instead of 9 × 6?
- Today, we solved 9 × 8 in different ways. How are the strategies we used in the Application Problem and Concept Development similar? How are they different?





Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

Multiply.

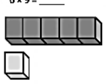
8 x 1 = _____	8 x 2 = _____	8 x 3 = _____	8 x 4 = _____
8 x 5 = _____	8 x 6 = _____	8 x 7 = _____	8 x 8 = _____
8 x 9 = _____	8 x 10 = _____	8 x 5 = _____	8 x 6 = _____
8 x 5 = _____	8 x 7 = _____	8 x 5 = _____	8 x 8 = _____
8 x 5 = _____	8 x 9 = _____	8 x 5 = _____	8 x 10 = _____
8 x 6 = _____	8 x 5 = _____	8 x 6 = _____	8 x 7 = _____
8 x 6 = _____	8 x 8 = _____	8 x 6 = _____	8 x 9 = _____
8 x 6 = _____	8 x 7 = _____	8 x 6 = _____	8 x 7 = _____
8 x 8 = _____	8 x 7 = _____	8 x 9 = _____	8 x 7 = _____
8 x 8 = _____	8 x 6 = _____	8 x 8 = _____	8 x 7 = _____
8 x 8 = _____	8 x 9 = _____	8 x 9 = _____	8 x 6 = _____
8 x 9 = _____	8 x 7 = _____	8 x 9 = _____	8 x 8 = _____
8 x 9 = _____	8 x 8 = _____	8 x 6 = _____	8 x 9 = _____
8 x 7 = _____	8 x 9 = _____	8 x 6 = _____	8 x 8 = _____
8 x 9 = _____	8 x 7 = _____	8 x 6 = _____	8 x 8 = _____

multiply by 8 (6–10)

Name ______________________________ Date ________________

1. Each [block] has a value of 9. Find the value of each row. Then, add the rows to find the total.

a. 6 × 9 = _____

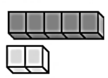


5 × 9 = 45

1 × 9 = _____

6 × 9 = (5 + 1) × 9
= (5 × 9) + (1 × 9)
= 45 + _____
= _____

b. 7 × 9 = _____

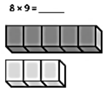


5 × 9 = 45

_____ × 9 = _____

7 × 9 = (5 + _____) × 9
= (5 × 9) + (_____ × 9)
= 45 + _____
= _____

c. 8 × 9 = _____

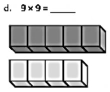


5 × 9 = _____

_____ × 9 = _____

8 × 9 = (5 + _____) × 9
= (5 × 9) + (_____ × _____)
= 45 + _____
= _____

d. 9 × 9 = _____



5 × 9 = _____

_____ × 9 = _____

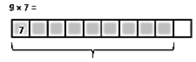
9 × 9 = (5 + _____) × 9
= (5 × 9) + (_____ × _____)
= 45 + _____
= _____

2. Find the total value of the shaded blocks.

a. 9 × 6 =

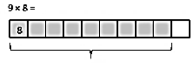
9 sixes = 10 sixes – 1 six
= _____ – 6
= _____

b. 9 × 7 =



9 sevens = 10 sevens – 1 seven
= _____ – 7
= _____

c. 9 × 8 =



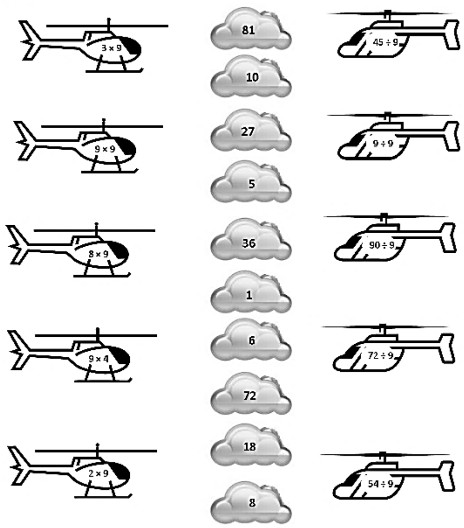
9 eights = 10 eights – 1 eight
= _____ – 8
= _____

d. 9 × 9 =

9 nines = 10 nines – 1 nine
= _____ – _____
= _____

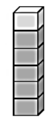
3. Matt buys a pack of postage stamps. He counts 9 rows of 4 stamps. He thinks of 10 fours to find the total number of stamps. Show the strategy that Matt might have used to find the total number of stamps.

4. Match.



Name ______________________________ Date ________________

1. Each [block] has a value of 9. Complete the equations to find the total value of the tower of blocks.



____ × 9 = (5 + ____) × 9

= (5 × ____) + (____ × ____)

= 45 + ____

= ____

2. Hector solves 9 × 8 by subtracting 1 eight from 10 eights. Draw a model, and explain Hector's strategy.

APPENDIX E

PRE-INTERVENTION SURVEY QUESTIONS

Mary Lou Fulton Teachers College
Arizona State University

Demographic Information

All data collected is anonymous, only myself and my dissertation chair, Dr. Molly Ott will have access to it. Data will be stored on a password protected computer and/or in a locked file cabinet for four years.

By completing this survey and submitting it, you understand that the data you contribute may be used in dissertations, publications and/or presentations. The results may be released to organizations, participants and schools as appropriate.

By continuing below, you are agreeing to your voluntary consent in this study.

Thank you for your participation!

Rebecca Freauff

Demographic Information

Knowing some things about you will help me in my study. The following four questions will help me to get know more about you.

How many years have you been teaching in the classroom?

This is my first year teaching in the classroom.	1-3 years	4-6 years	7-9 years	I have been teaching 10 or more years in the classroom
○	○	○	○	○

What grade level do you primarily teach? (check all that apply)

Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Other
☐	☐	☐	☐	☐	☐	☐

I am

- Male
- Female
- Not listed

What is your age group?

- 18 - 24
- 25 - 34
- 35 - 44
- 45 - 54
- 55 - 64
- Prefer not to answer

What is the highest degree or level of school you have completed? *If currently enrolled, highest degree received.*

- Associate's degree
- Bachelor's degree
- Master's degree
- Professional Degree
- Doctorate

Do you teach math using the Engage NY math curriculum?

- Yes
- No

Experience with Engage NY Math Curriculum (Pre and Post Intervention)

Experience with Engage NY Math Curriculum

This section is to determine the length of time you have taught with Engage NY math, your comfort level with the content and to determine if you use any type of digital presentation software to teach the math curriculum.

How many years you been teaching using the Engage NY Math curriculum?

This is my first year teaching Engage NY math.	1-3 years	4-6 years	7-9 years	I have been teaching Engage NY math for more than 10 years.
○	○	○	○	○

How do you prepare to teach an EngageNY math lesson? Check the option that most closely resembles your process.

- I skim the lesson in the teacher’s manual for key ideas before I teach the lesson.
- I read the entire lesson in the teacher’s manual before I teach the lesson.
- I skim the teacher’s manual for key ideas during the lesson.
- I read the entire lesson from the teacher’s manual during the lesson.
- I use digital presentations to present the content.
- Other (please explain):

Approximately how many hours per week do you spend preparing to teach the Engage NY math content (do not include time spent making copies or gathering materials).

None	Less than 1 hour	1-2 hours	2-4 hours	More than 4 hours
○	○	○	○	○

At any time in the past, have you used a digital presentation such as PowerPoint, Prezi, Smart Board, etc. to present Engage NY math content?

- Yes
- No

Where did you obtain the digital presentation you used to teach EngageNY math?

- I created my own digital presentations to teach EngageNY math.
- The presentation was provided to me by someone else.
- I purchased the presentation myself.
- I have not used digital presentations when presenting Engage NY material.

Where did you purchase the presentation(s)?

- Teachers Pay Teachers
- Teacher’s Notebook
- Other:

Why did you purchase presentations for the EngageNY math curriculum?

How often did you use the following formats:

	Always	Most of the time	About half the time	Sometimes	Never
PowerPoint	O	O	O	O	O
Prezi	O	O	O	O	O
Google Slides	O	O	O	O	O
SMART notebook	O	O	O	O	O
Other Interactive Whiteboard Software	O	O	O	O	O
Other	O	O	O	O	O

How often did you include the following you created your own digital presentations?

	Always	Most of the time	About half the time	Sometimes	Never
Lesson Objective	O	O	O	O	O
Teacher's Notes	O	O	O	O	O
Examples of student thinking	O	O	O	O	O
Examples of concepts	O	O	O	O	O
Pictures of concepts	O	O	O	O	O
Possible student responses	O	O	O	O	O
Possible student misconceptions	O	O	O	O	O
Content directly from the teacher's manual	O	O	O	O	O
Content modified by me	O	O	O	O	O

How well do you...

	Extremely well	Very well	Moderately well	Slightly well	Not well at all
understand the teaching strategies presented in the Engage NY Math curriculum?	O	O	O	O	O

	Extremely well	Very well	Moderately well	Slightly well	Not well at all
demonstrate and model the mathematical concepts presented in each Engage NY lesson?	O	O	O	O	O
present and work through word problems with your students.	O	O	O	O	O
summarize the learning objectives for each Engage NY math lesson?	O	O	O	O	O

Overall Perceptions of Presentations (Pre- and Post Intervention)

Overall Perceptions of Presentations

The following questions ask for your opinion about digital presentations such as PowerPoint or Prezi in the classroom. Based on your experience, please answer the questions below. Everyone has their own expectations of what should be included in digital presentations. There are no right or wrong answers; select the choice that best matches your beliefs.

Digital presentations (PowerPoint, Prezi, etc.) allow the presenter to tell a story with pictures and key phrases.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) are engaging.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) help the presenter organize key concepts.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage the presenter to interact with their audience.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital Presentations (PowerPoint, Prezi, SMART board, etc.) encourage questions from students.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital Presentations (PowerPoint, Prezi, SMART board, etc.) encourage students' participation.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Evaluation of Engage NY Math Digital Presentations (Post Intervention)

Evaluation of Engage NY Math Digital Presentations

The following questions ask for your opinion about EngageNY digital presentations you used during the study. Based on your experience with those presentations, please rate them based on the criteria below. Each person has their own expectations of what should be included in presentations. There are no right or wrong answers; select the one that best matches your beliefs.

Using the PowerPoint presentations saved time.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

It is easy to teach the math lesson using digital presentations.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

The digital presentations kept students engaged throughout the lesson.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

The digital presentations contained all the necessary information to teach each lesson.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson pacing.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson flow.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased understanding.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased engagement.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) support teacher learning.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) help teachers understand content on a deeper level.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) helps teachers explain concepts in student friendly language.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Teacher Suggestions (Post Intervention)

Teacher Suggestions

These questions are an opportunity for you to make suggestions about how EngageNY math presentations might be updated, changed and/or improved.

What do you believe are the most valuable aspects of the digital presentations for Engage NY Math?

Do you feel anything is missing from the current presentations?

Please add anything you think would make the presentations more effective, engaging or user friendly.

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APPENDIX F

POST-INTERVENTION SURVEY QUESTIONS

Mary Lou Fulton Teachers College
Arizona State University

Demographic Information

Thank you so much for participating in my study. This is the last portion.

As a reminder, all data collected is confidential; only myself and my dissertation chair, Dr. Molly Ott will have access to it. Data will be stored on a password protected computer and/or in a locked file cabinet for four years.

By completing this survey and submitting it, you understand that the data you contribute may be used in dissertations, publications and/or presentations. The results may be released to organizations, participants and schools as appropriate. By continuing below, you are agreeing to your voluntary consent in this study.

Once I receive your responses to this final survey, I will send a link via email that will give you access to the rest of the presentations. If you are having trouble accessing it for any reason, please feel free to contact me via email. I can be reached at rebecca.freauff@asu.edu.

Thank you,
Rebecca Freauff
Doctoral Candidate, Arizona State University

Demographic Information

What grade level do you primarily teach? (check all that apply)

Kindergarten	First Grade	Second Grade	Third Grade	Fourth Grade	Fifth Grade	Other
☐	☐	☐	☐	☐	☐	☐

How many years have you been teaching in the classroom?

This is my first year teaching in the classroom.	1-3 years	4-6 years	7-9 years	I have been teaching 10 or more
	○	○	○	

years in the classroom

Evaluation of Engage NY Math Digital Presentations (Post Intervention)

Evaluation of Engage NY Math Digital Presentations

The following questions ask for your opinion about EngageNY digital presentations you used during the study. Consider your experience with those presentations and rate them based on the criteria below. Each person has their own expectations of what should be included in presentations. There are no right or wrong answers; select the one that best matches your beliefs.

Approximately how many hours per week do you spend preparing to teach the Engage NY math content for any given lesson (do not include time spent making copies or gathering materials).

None	Less than 1 hour	1-2 hours	2-4 hours	More than 4 hours
○	○	○	○	○

Has using the presentations changed how you prepare to teach an EngageNY math lesson? Check the option that most closely resembles your process.

○ No, using the presentations has not changed how I prepare to teach an Engage NY math lesson. In the space below, please explain how you prepare for each lesson.

○ Yes, using the presentations has changed how I prepare to teach and Engage NY math lesson. In the space below, please explain how your process has changed.

How well do you feel that you...

	Extremely well	Very well	Moderately well	Slightly well	Not well at all
understand the teaching strategies presented in the Engage NY Math curriculum?	○	○	○	○	○
demonstrate and model the mathematical concepts presented in each Engage NY lesson?	○	○	○	○	○
present and work through word problems with your students.	○	○	○	○	○
summarize the learning objectives for each Engage NY math lesson?	○	○	○	○	○

Using the PowerPoint presentations saved time in lesson planning and preparation.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
○	○	○	○

Using the PowerPoint presentations saved time in lesson pacing.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
○	○	○	○

The digital presentations contained all the necessary information to teach each lesson.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
○	○	○	○

It is easy to teach the math lesson using digital presentations.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

The digital presentations kept students engaged throughout the lesson.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Overall Perceptions of Presentations (Pre- and Post Intervention)

Overall Perceptions of Presentations

The following questions ask for your opinion about digital presentations such as PowerPoint or Prezi in the classroom. Based on your experience, please answer the questions below. Everyone has their own expectations of what should be included in digital presentations. There are no right or wrong answers; select the choice that best matches your beliefs.

Digital presentations (PowerPoint, Prezi, etc.) allow the presenter to tell a story with pictures and key phrases.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) are engaging.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) help the presenter organize key concepts.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) encourage the presenter to interact with their audience.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree

Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson pacing.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) improve lesson flow.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased understanding.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) support student learning through increased engagement.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) support teacher learning.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) help teachers understand content on a deeper level.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital presentations (PowerPoint, Prezi, SMART board, etc.) helps teachers explain concepts in student friendly language.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital Presentations (PowerPoint, Prezi, SMART board, etc.) encourage questions from students.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Digital Presentations (PowerPoint, Prezi, SMART board, etc.) encourage students' participation.

Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
O	O	O	O

Teacher Suggestions (Post Intervention)

Teacher Suggestions

These questions are an opportunity for you to make suggestions about how the EngageNY math presentations used in this study might be updated, changed and/or improved.

Did you find value in the use of the PowerPoint presentations created from the teacher's manuals. If so, what do you believe was the most valuable aspect of the digital presentations for Engage NY Math? If not, why?

Please add anything you think would make the presentations more effective, engaging or user friendly.

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APPENDIX G

DIGITAL PRESENTATION KINDERGARTEN MODULE 3 LESSON 12

ENGAGE NY **KINDERGARTEN** PRESENTATION

Module 3 Lesson 12

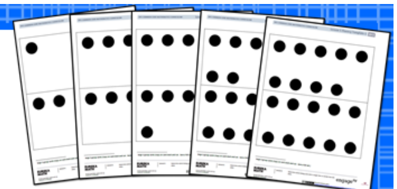
Objective:

Compare the weight of an object with sets of different objects on a balance scale.

Teach the WAY They Learn

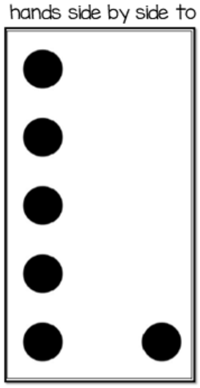
Fluency Practice

5-Group Hands
K.CC.2



Materials: (T) Large 5-group cards in vertical orientation (M5 Fluency Template 1)

Note: Conduct as described in Lesson 5, showing the 5-group cards in the vertical orientation. Accordingly, students should put their hands side by side to represent the number.

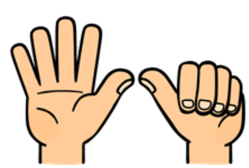


Raise your hand when you know how many dots are on the left.

How many on the right?

We can show this 5-group on our hands.

Five on the left and 1 on the right, like this.



Push your hands out as you count on from 5, like this. 5 (extend the left hand forward), 6 (extend the right hand forward). Try it with me.

Continue with 5, 6, and 7, steadily decreasing guidance from the teacher, until students can show the 5-groups on their hands with ease.

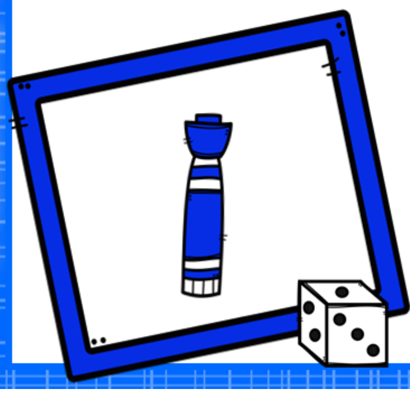
Fluency Practice

Roll and Draw 5-Groups
K.OA.3

Materials: (S) Die (with the 6-dot side covered), personal white board

Note: Conduct as outlined in Lesson 7. Consider alternating between drawing the 5-groups vertically and drawing them horizontally.

Roll the die, count the dots, and then draw the number as a 5-group.



Fluency Practice

Hidden Numbers on the Dot Path
K.OA.3

Materials: (S) Dot path (Lesson 5 Fluency Template 2) inserted into personal white board

Note: Finding embedded numbers anticipates the work of Module 4 by developing part-whole thinking.

Fold your dot path so that you can see only 6 dots.

Place it inside your personal white board.

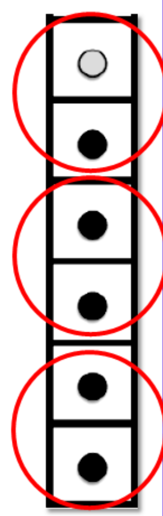
How many dots can you see?

Circle 2 of them.

See how many twos you can circle on your dot path.

How many dots are on the whole dot path?

How many twos did you find hiding within the 6?



Continue the process with finding groups of 3 within the 6. Guide students to find a group of 4 or 5 and then tell what number of dots remains.

Application Problem

Find one small item in your backpack.

Put it on the balance scale.

How many pennies do you think it will take to balance your object?

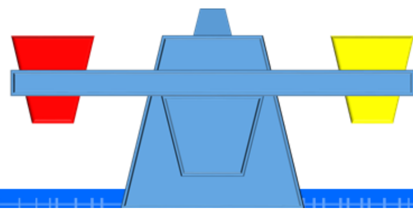
Use pennies to test your guess.

Make a picture of the balance with your object and the pennies.

Finish this sentence, "My item is as heavy as a set of _____ pennies."

What do you think would happen if you put another penny on each side of the balance scale?

Test your guess!



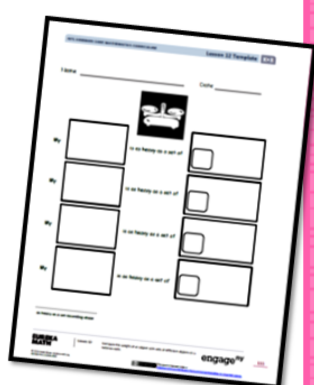
Concept Development

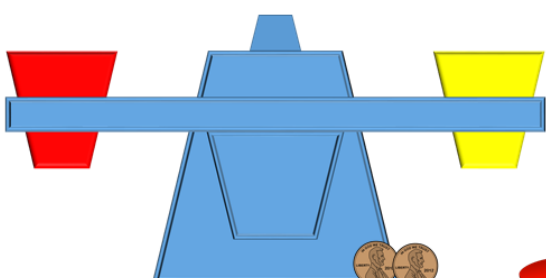
Materials: (T) Simple balance scale, marker, 2 pennies, small bag of linking cubes, small counters, beans, and as heavy as a set recording sheet (Template) (S) 1 simple balance scale per pair or small group of students, 4 small bags of various items to use as weights (pennies, linking cubes, small counters, and large dried beans), collection of classroom objects for the balance exercise, and as heavy as a set recording sheet (Template)

Look carefully at my balance.

Now, watch as I put my marker on one side.

Do you remember how I weighed my marker yesterday?



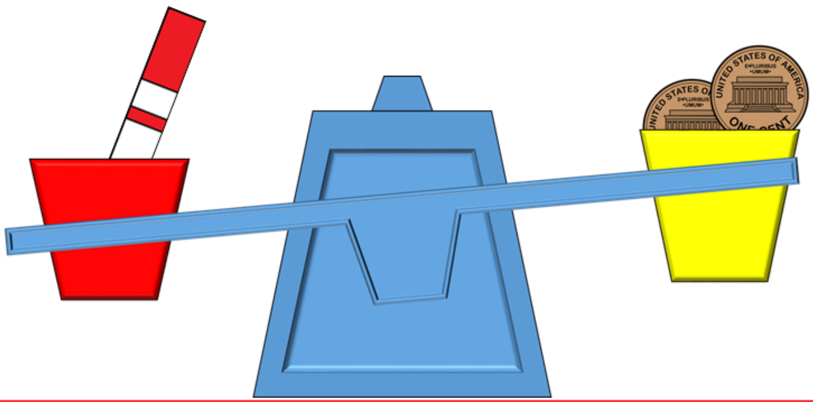


Concept Development

Let's try that again.

I have a set of 2 pennies.

Watch and see if the scale balances.



Concept Development

My marker is heavier than a set of 2 pennies.

I don't have any more pennies.

What should I do?

Look at the other items on the table.

Is there another way to see how heavy the marker is?

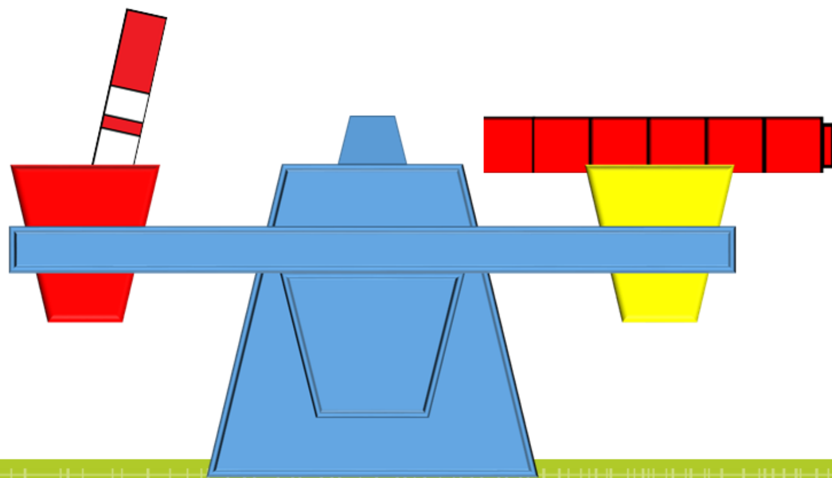
Concept Development

Could I use my two pennies and a cube?

I'll take the pennies off and use a tower of cubes.

Help me count how many cubes would be in a tower as heavy as my marker.

My marker is as heavy as a tower of 6 cubes.

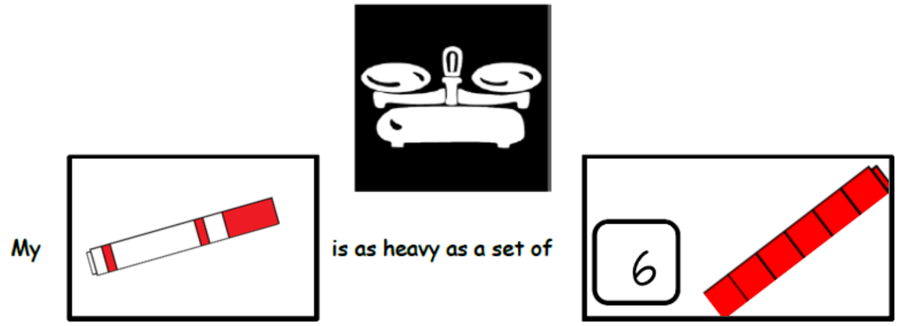


Concept Development

Let me put that on the recording sheet.

I will draw the marker and the cubes, and I will write how many cubes in the box.

What else could I use?



Concept Development

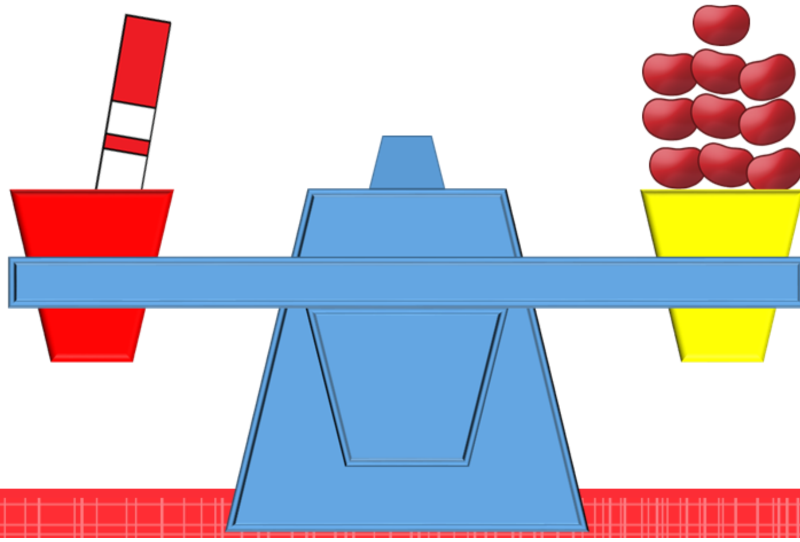
(Repeat the experiment and recording with beans and small counters.)

What else could I use?

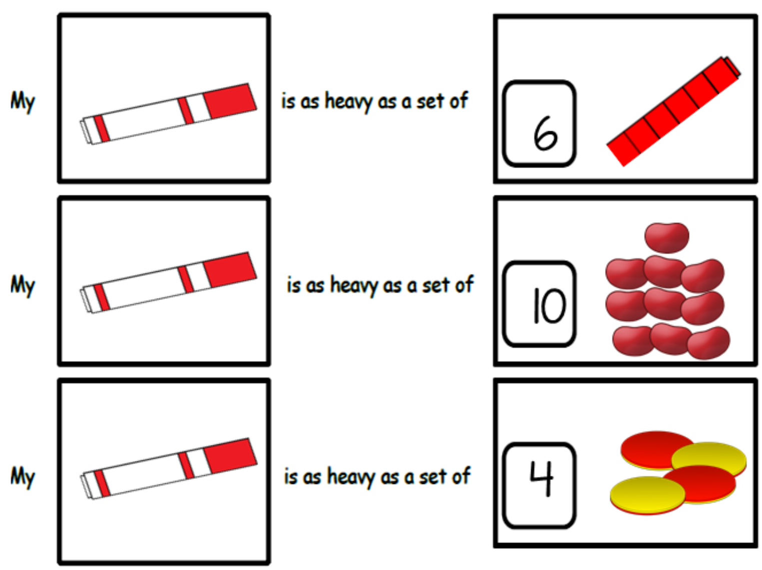
I will take off the cubes and use a set of beans this time.

I wonder how many beans it will take to balance my marker.

Count with me.



Concept Development



Wow! Look what we've discovered.

My marker is as heavy as a tower of 6 cubes.

My marker is as heavy as a set of 10 beans.

My marker is as heavy as a set of 4 counters.

Why are all the numbers different?

Concept Development

You and your partner can try this, too.

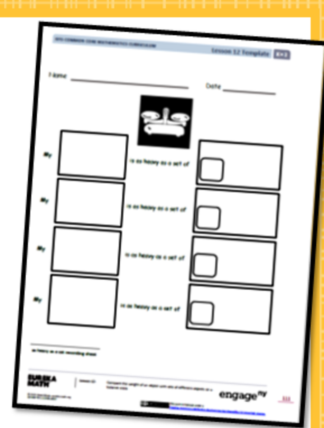
Choose one object from your bag.

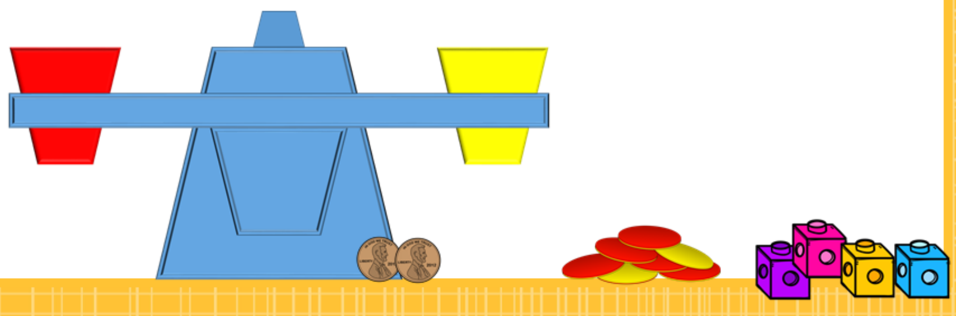
Count how many pennies are as heavy as your object, and record it on your sheet.

Then, count how many cubes are as heavy as the object.

Do the same thing with the beans and the counters.

Don't forget to guess before you test!



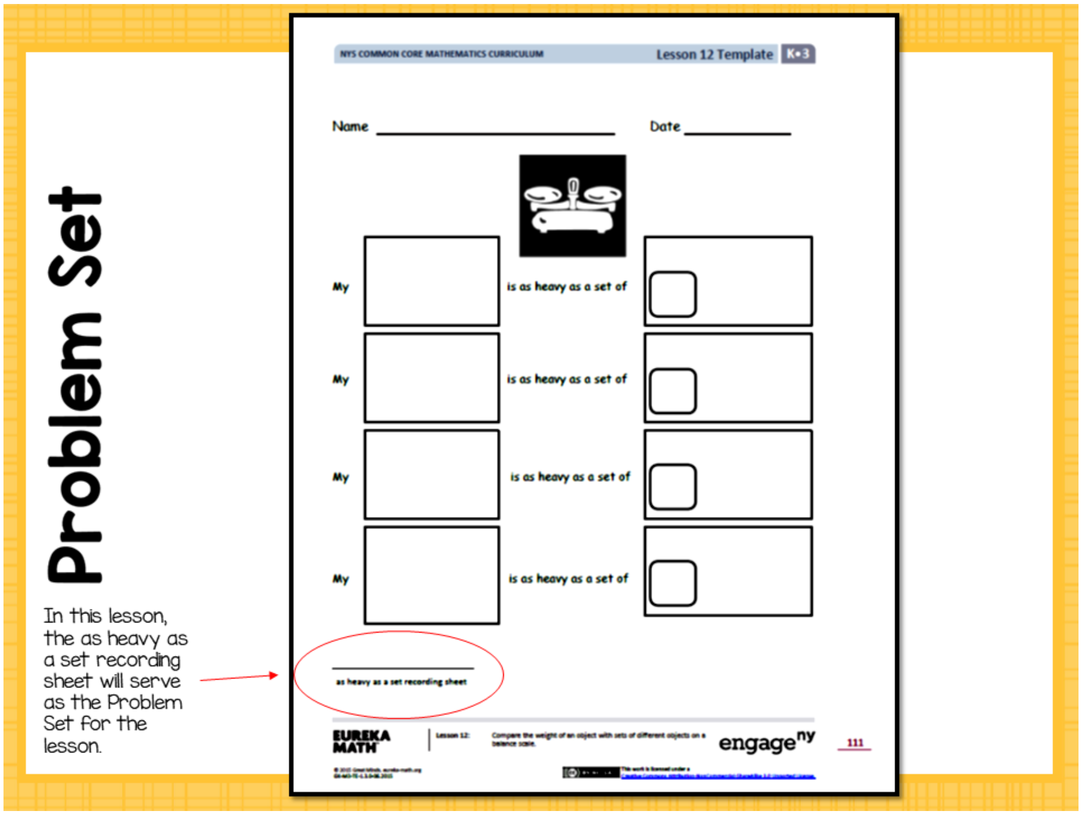


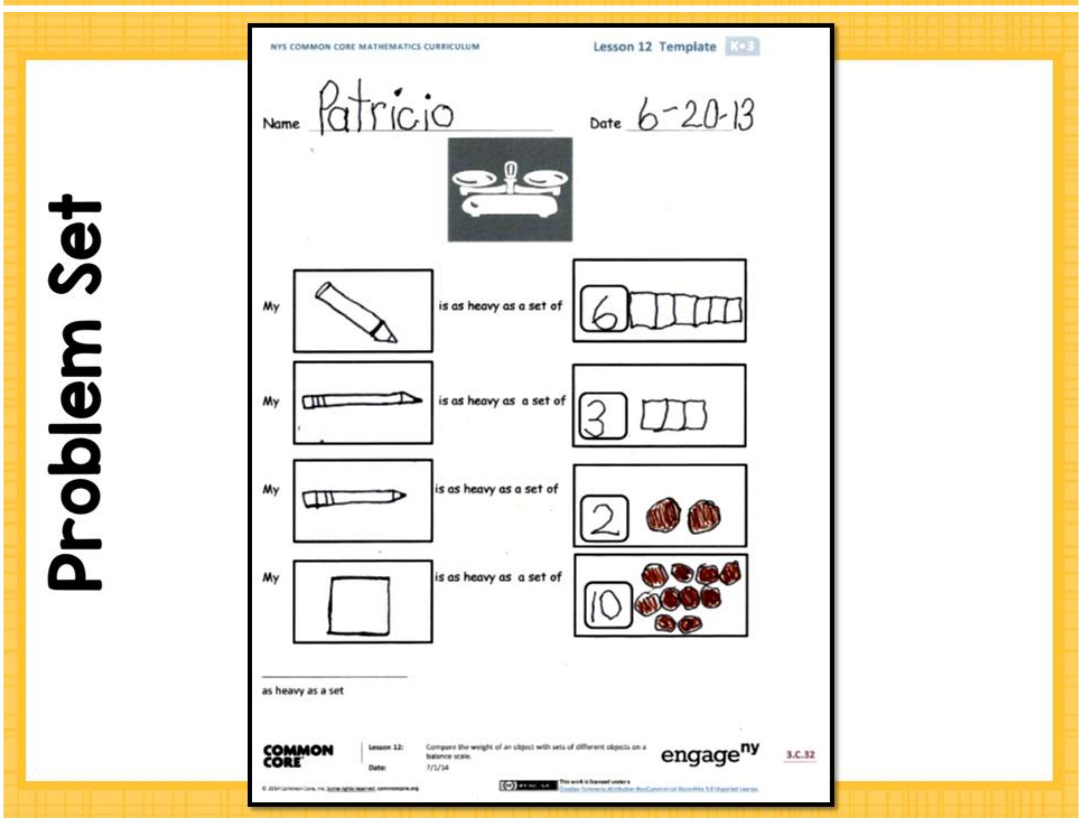
Concept Development

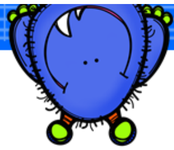
Put your things away.

Who would like to share his or her recording sheet with our class?

What did you discover?


Problem Set
In this lesson, the as heavy as a set recording sheet will serve as the Problem Set for the lesson.
NYS COMMON CORE MATHEMATICS CURRICULUM
Lesson 12 Template K•3
Name
Date
My
is as heavy as a set of
My
is as heavy as a set of
My
is as heavy as a set of
My
is as heavy as a set of
as heavy as a set recording sheet
EUREKA MATH
engage^ny
111


Problem Set
NYS COMMON CORE MATHEMATICS CURRICULUM
Lesson 12 Template K•3
Name Patricio
Date 6-20-13
My
is as heavy as a set of
6
My
is as heavy as a set of
3
My
is as heavy as a set of
2
My
is as heavy as a set of
10
as heavy as a set
COMMON CORE
engage^ny
3.C.32



Student Debrief

Lesson Objective:

Compare the weight of an object with sets of different objects on a balance scale.

- Did you notice any patterns as you were balancing your object with sets of different things?
- Which set of things was the biggest? Which set was the smallest?
- Why were all of the sets different sizes?
- Compare your recording sheet with your friends'. Did you find the same answers?
- What math vocabulary did we use today to communicate precisely? Lesson 12: Compare the weight of an object with sets of different objects on a balance scale.

Exit Ticket

No Exit Ticket Today

APPENDIX H

DIGITAL PRESENTATION 1ST GRADE MODULE 6 LESSON 11

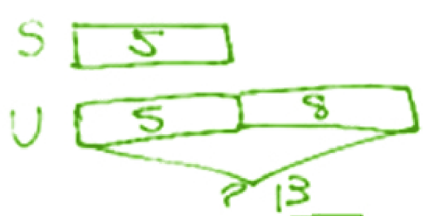
Module 6 Lesson 11

Objective:

Add a multiple of 10 to any two-digit number within 100.

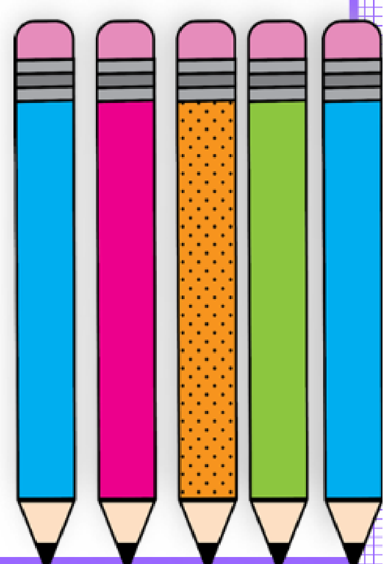
Application Problem

Ben sharpened 5 pencils. He has 8 more unsharpened pencils than sharpened pencils. How many unsharpened pencils does Ben have?



$5 + 8 = \boxed{13}$

Ben has 13 unsharpened pencils.



Core Fluency Differentiated Practice Sets 1.OA.6

Materials: (S) Core Fluency Practice Sets

Note: Give the appropriate Practice Set to each student. Students who completed all questions correctly on their most recent Practice Set should be given the next level of difficulty. All other students should try to improve their scores on their current levels. Core Fluency Differentiated Practice Sets are used throughout this module.

Students complete as many problems as they can in 90 seconds. Assign a counting pattern and start number for early finishers, or have them practice make ten addition or subtraction on the back of their papers. Collect and correct any Practice Sets completed within the allotted time.

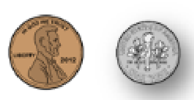
Coin Drop
1.NBT.5, 1.MD.3

Materials: (T) 10 dimes, 10 pennies, can

Note: This activity reviews yesterday's lesson (Lesson 10), where students added and subtracted tens within 100.

Name my coin.

How much is it worth?



Listen carefully as I drop coins in my can.

Count along in your minds.

Drop in some pennies, and ask how much money is in the can. Take out some pennies, and show them. Ask how much money is still in the can. Continue adding and subtracting pennies for a minute or so. Then, repeat the activity with dimes. Now that students have learned to add and subtract multiples of 10 from multiples of 10, the teacher may take out more than one dime at a time and have students calculate the remaining dimes.

Get to the Next Ten
1.NBT.4

Note: This fluency activity builds on Lesson 10's Get to Ten(s) activity to prepare students for Lesson 13.

I will say a number.

You say an addition sentence to get to the **next multiple of 10**.

Say the addition sentence to get to the next ten.

9.

59.

Continue with the following suggested sequence: 5, 65, 8, 78, 7, 87, and 6, 96.

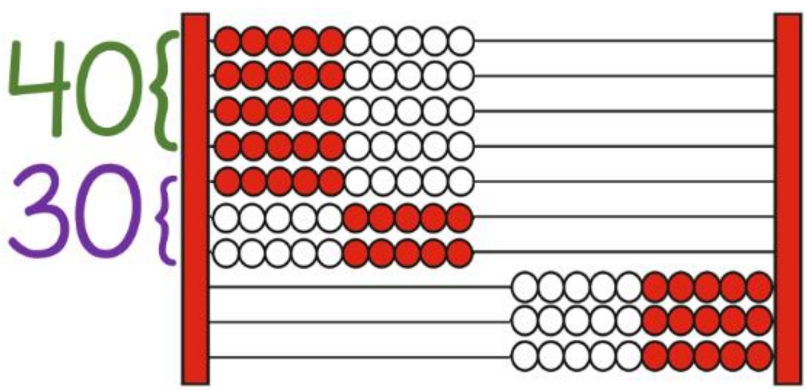
Concept Development

Materials: (T) 100-bead Rekenrek (S) Personal white board

Have students gather in the meeting area in a semicircle formation with their materials.

On your personal white board, write the number sentence, and replace the question mark with the missing number.

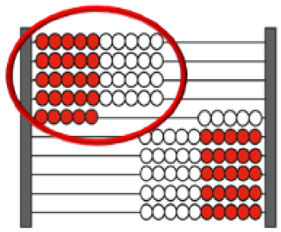
40 + 30 is...?



Concept Development

Explain how you know that 40 + 30 equals 70.

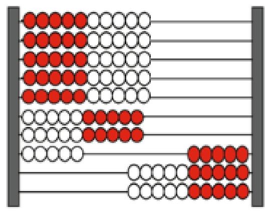
You can draw or write on the chart paper to explain your thinking.



45 + 30 = ?

On your personal white board, write this number sentence, and replace the question mark with the solution.

45 + 30 is...?



Concept Development

Did anyone solve 45 + 30 with the counting on solution?

45, 55, 65, 75

Concept Development

Did anyone solve 45 + 30 with the number bond solution?

$40 + 30 = 70$
$70 + 5 = 75$

I broke 45 into 40 and 5 with the number bond, and then I added 40 and 30 first, which is 70, and then added on 5 to make 75.

$45 + 30 = 75$

5   40

Concept Development

Did anyone solve 45 + 30 with the place value chart solution?

tens	ones
4	5

+3 tens →

tens	ones
7	5

I thought of the place value chart and just added 3 tens to 4 tens and left the 5 ones alone. That gave me 75.

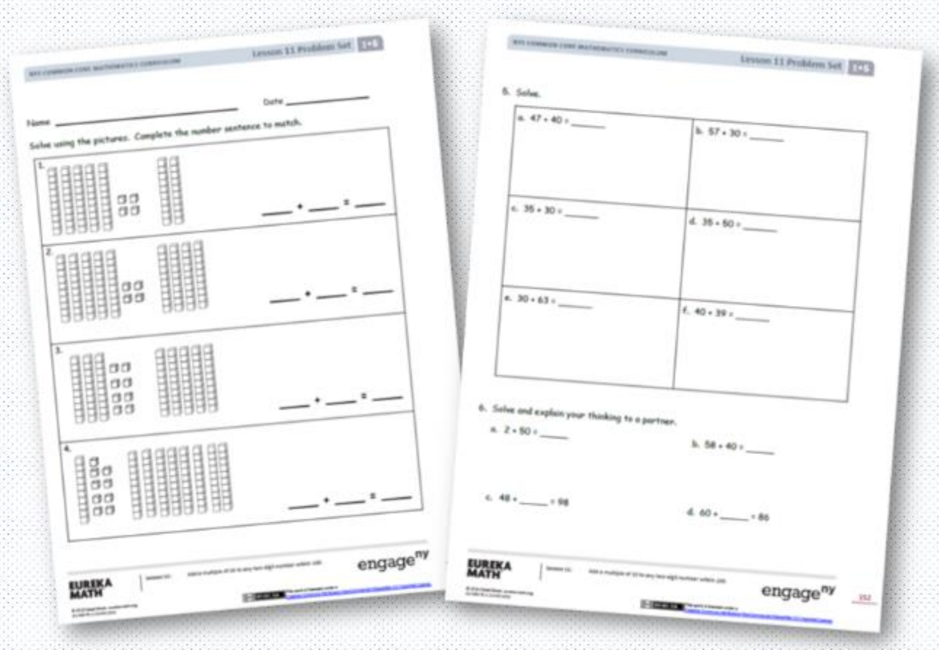
Concept Development

Provide time for students to solve the following suggested sequence of problems. Students who would benefit from more concrete or pictorial support may use linking cubes in ten-sticks and ones, dimes and pennies, or quick ten drawings.

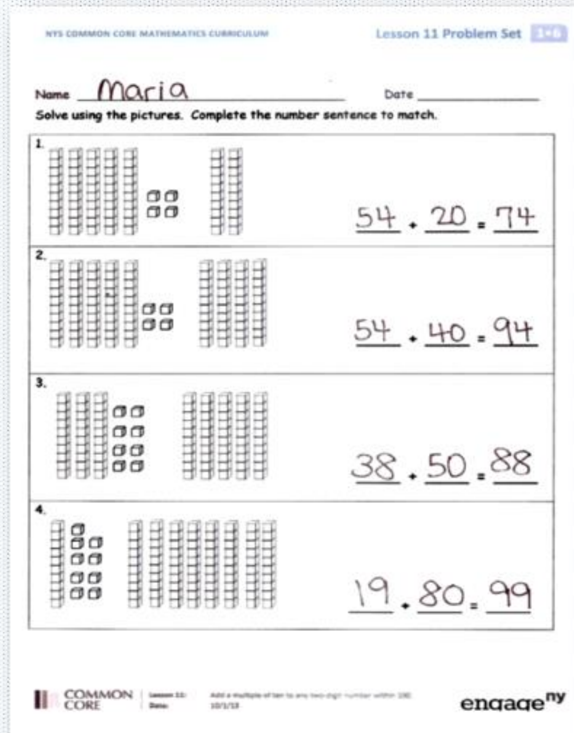
- 51 + 40
- 24 + 60
- 50 + 38
- 62 cents + 3 dimes
- 8 dimes + 12 cents
- 63 + ____ = 93
- 14 + ____ = 74
- ____ + 39 = 59
- ____ + 40 = 98

After each problem, have one or two students share a different method for solving the problem.

Problem Set



Problem Set


NYS COMMON CORE MATHEMATICS CURRICULUM | Lesson 11 Problem Set 1•6

Name Maria Date

Solve using the pictures. Complete the number sentence to match.

1. 54 + 20 = 74
2. 54 + 40 = 94
3. 38 + 50 = 88
4. 19 + 80 = 99

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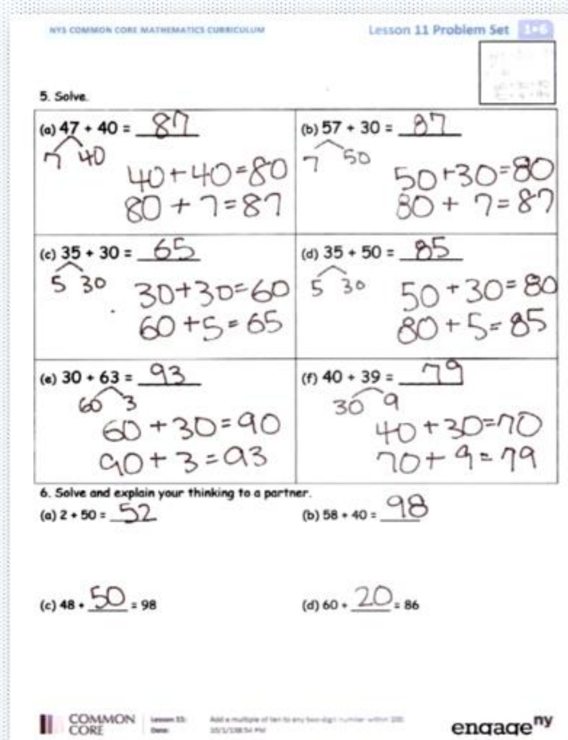
Problem Set


NYS COMMON CORE MATHEMATICS CURRICULUM | Lesson 11 Problem Set 1•6

5. Solve.

(a) 47 + 40 = 87 7 40 40+40=80 80 + 7=87	(b) 57 + 30 = 87 7 50 50+30=80 80 + 7=87
(c) 35 + 30 = 65 5 30 30+30=60 60 +5=65	(d) 35 + 50 = 85 5 30 50+30=80 80+5=85
(e) 30 + 63 = 93 60 3 60 +30=90 90+3=93	(f) 40 + 39 = 79 30 9 40+30=70 70+9=79

6. Solve and explain your thinking to a partner.

(a) 2 + 50 = 52 (b) 58 + 40 = 98

(c) 48 + 50 = 98 (d) 60 + 20 = 86

COMMON CORE engage^ny

Student Debrief

Lesson Objective:

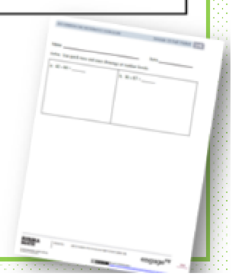
Add a multiple of 10 to any two-digit number within 100.

- Look at Problem 5 (c) and (d). How could solving Problem 5(c) help you solve Problem 5(d)?
- Look at Problem 6 (a) and (b). Did you or your partner use a different strategy than the number bond work from the top of the page? If so, explain your strategy.
- Look at Problem 6 (c) and (d). How did you find the missing addends? Explain your thinking.
- How is today's work similar to and different from yesterday's work?
- How did the coin drop fluency activity help you get better at adding tens?

Exit Ticket

Solve. Use quick tens and ones drawings or number bonds.

a. 42 + 50 = _______	b. 30 + 57 = _______



APPENDIX I

DIGITAL PRESENTATION 2ND GRADE MODULE 4 LESSON 12

ENGAGE NY 2ND GRADE MATH PRESENTATION

Module 4 Lesson 12

Lesson Objective:

Relate manipulative representations to a written method.

Teach the WAY They Learn

Using 10 to Subtract 2.NBT.5

Repeat the fluency activity from Lesson 11.

16 - 9

The answer is...?

Wait for the signal.

16

/ \

10 6

10 - 9 is...?

1 + 6 is...?

Continue with the following possible sequence: 15 - 9, 13 - 8, 15 - 7, 16 - 7, 12 - 9, and 13 - 7.

Get the Ten Out to Subtract
2.NBT.5

Note: Students practice taking out the ten and subtracting to prepare for unbundling a ten in today's lesson.

For every number sentence I give, subtract the ones from ten.

When I say 12 - 4, you say 10 - 4 = 6.

Ready?

12 - 4.

13 - 7.

Practice taking the ten out of number sentences fluently before adding the ones back.

Now let's add back the ones.

12 - 4.

Take from ten.

Now add back the ones.

Continue with the following possible sequence: 13 - 7, 11 - 8, 13 - 9, 15 - 7, and 14 - 8.

How Many More Tens
2.NBT.5

Materials: (S) Personal white board

Note: Practice adding and subtracting multiples of 10 prepares students for the lesson.

If I say 45 - 35, you say 10.

To say how many more tens in a sentence, you say 45 is 10 more than 35.

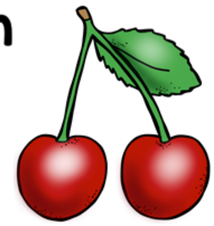
Ready?

65 - 45.

Say it in a sentence.

Continue with the following possible sequence: 85 - 45, 74 - 24, 59 - 29, 38 - 18, and 99 - 19.

Application Problem

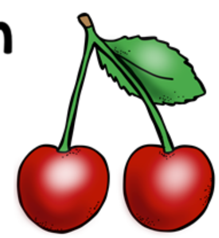


Barb has a bag of 34 cherries.

She eats 17 cherries for a snack.

How many cherries does she have left?

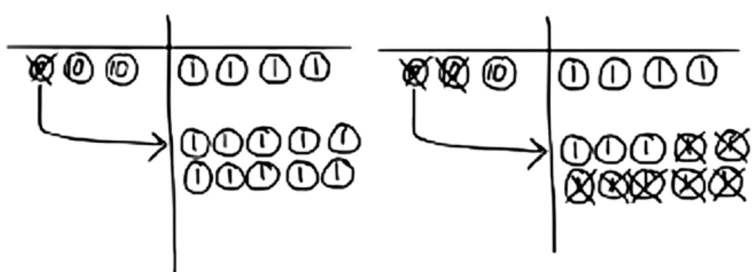
Application Problem



Barb has a bag of 34 cherries.

She eats 17 cherries for a snack.

How many cherries does she have left?



$34 - 17 = 17$

Barb has 17 cherries left.

Concept Development

Materials: (T) Place value disks (19 ones and 9 tens), unlabeled tens place value chart (Lesson 1 Template) (S) Place value disks (19 ones and 9 tens), unlabeled tens place value chart (Lesson 1 Template), personal white board, place value disks (Lesson 6 Template)

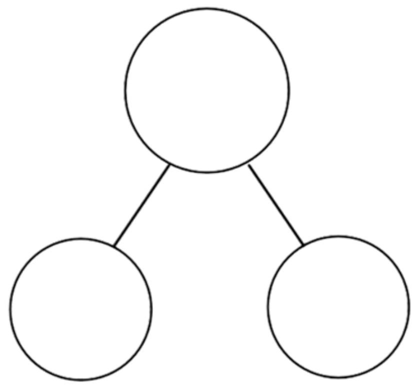
Problem 1: 25 - 11

Read this problem with me.

What is the whole?

What is the part that we know?

What do we need to find?

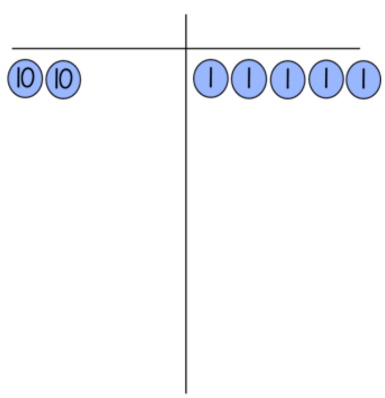


Concept Development

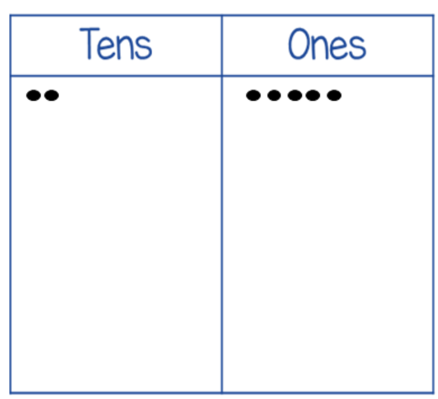
When we use place value disks to solve a subtraction problem, we only put the whole on our chart.

Turn to your neighbor, and tell him or her why we only show the whole when subtracting.

Count the total value of the disks. Say the units, too.



Disks



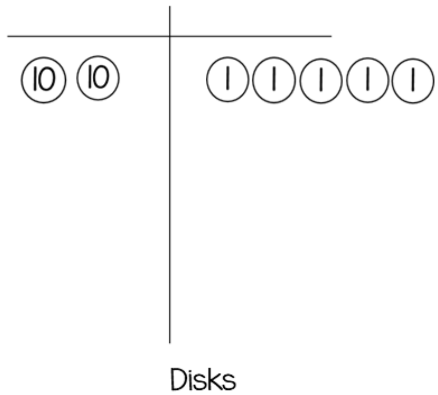
Chip chart

Concept Development

Today, as we solve subtraction problems, we are going to record our work in vertical form.

We want to look carefully at the whole when subtracting, like a detective, to see if we need to do any unbundling.

Let's draw an imaginary magnifying glass around 25.



Let's start by looking at the smallest place value, the ones: Can we take 1 one disk from 5 ones disks?

Concept Development

Let's move to the tens column. Can I take 1 ten from 2 tens?

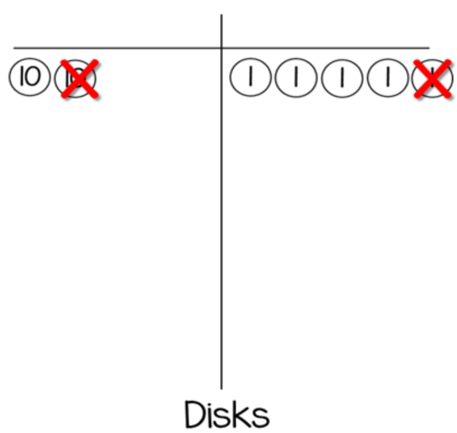
We are ready to subtract because we have checked to make sure we have enough units in each place value.

Take 1 one from the 5 ones.

How many ones are left?

Take 1 ten from 2 tens.

What is 25 - 11?



Concept Development

Problem 2: 22 - 13

Let's try another problem together.

This time I want you to record your answers vertically as I do.

22 - 13 = What should I do first?

Okay, I'm looking closely at it.

Where do I start?

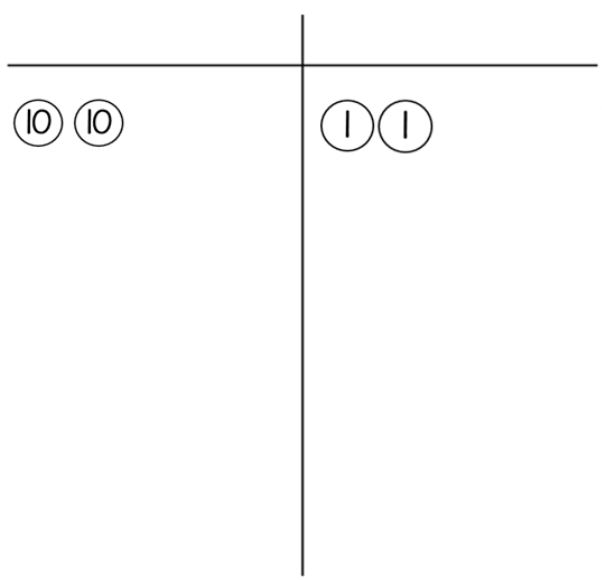
Can I subtract 3 ones from 2 ones?

What should I do?

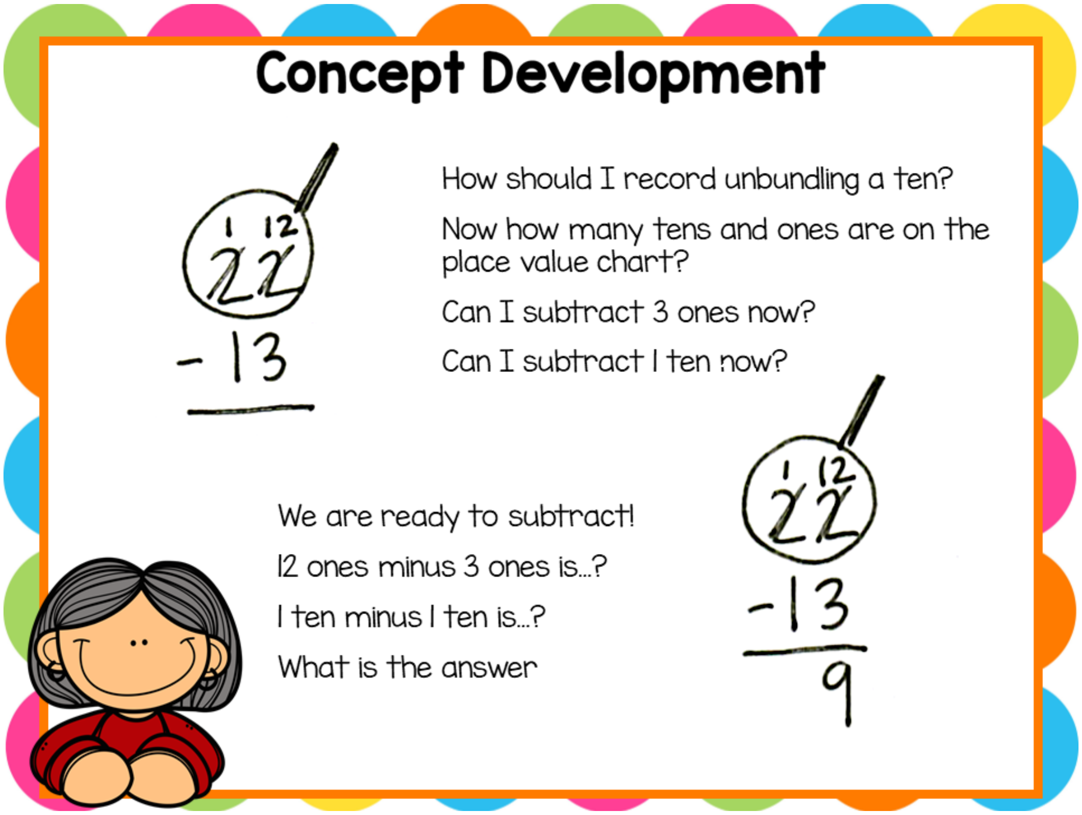
Whatever I do to my place value disks, I must also do to the numbers in vertical form.

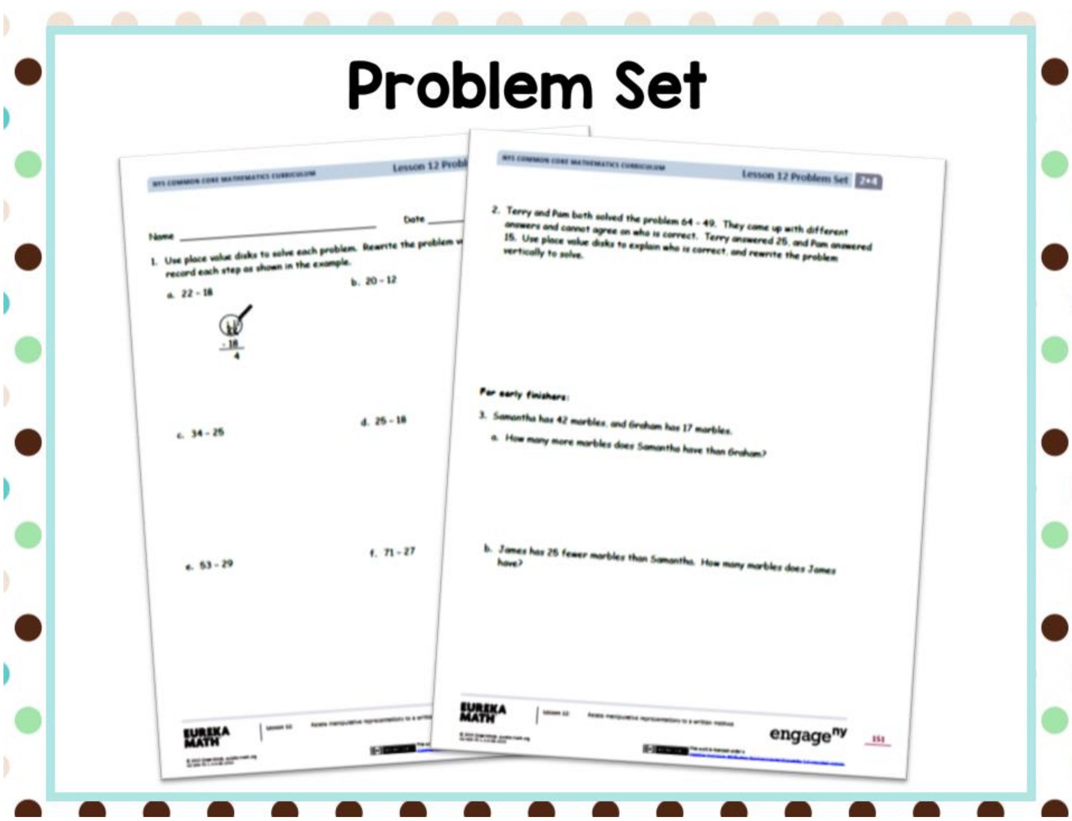
$$\begin{array}{r} 22 \\ -\,13 \\ \hline \end{array}$$

Concept Development



$$\begin{array}{r} 22 \\ -\,13 \\ \hline \end{array}$$


Concept Development
How should I record unbundling a ten?
Now how many tens and ones are on the place value chart?
Can I subtract 3 ones now?
Can I subtract 1 ten now?
We are ready to subtract!
12 ones minus 3 ones is...?
1 ten minus 1 ten is...?
What is the answer
1 12
22
- 13
9


Problem Set
Lesson 12 Problem Set
2. Terry and Pam both solved the problem 64 - 49. They came up with different answers and cannot agree on who is correct. Terry answered 25, and Pam answered 15. Use place value disks to explain who is correct, and rewrite the problem vertically to solve.
For early finishers:
3. Samantha has 42 marbles, and Graham has 17 marbles.
a. How many more marbles does Samantha have than Graham?
b. James has 25 fewer marbles than Samantha. How many marbles does James have?
engage ny

Problem Set

Name Ben Date

1. Use place value disks to solve each problem. Rewrite the problem vertically, and record each step as shown in the example.

a. 22 – 18

$$\begin{array}{r} \overset{1\,12}{\cancel{2}\cancel{2}} \\ -18 \\ \hline 4 \end{array}$$

b. 20 – 12

$$\begin{array}{r} \overset{1\,10}{\cancel{2}\cancel{0}} \\ -12 \\ \hline 8 \end{array}$$

c. 34 – 25

$$\begin{array}{r} \overset{2\,14}{\cancel{3}\cancel{4}} \\ -25 \\ \hline 9 \end{array}$$

d. 25 – 18

$$\begin{array}{r} \overset{1\,15}{\cancel{2}\cancel{5}} \\ -18 \\ \hline 7 \end{array}$$

e. 53 – 29

$$\begin{array}{r} \overset{4\,13}{\cancel{5}\cancel{3}} \\ -29 \\ \hline 24 \end{array}$$

f. 71 – 27

$$\begin{array}{r} \overset{6\,11}{\cancel{7}\cancel{1}} \\ -27 \\ \hline 44 \end{array}$$

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Problem Set

2. Terry and Pam both solved the problem 64 – 49. They came up with different answers and can't agree on who is correct. Terry answered 25 and Pam answered 15. Use place value disks to explain who is correct and rewrite the problem vertically to solve.

$$\begin{array}{r} \overset{5\,14}{\cancel{6}\cancel{4}} \\ -49 \\ \hline 15 \end{array}$$

Pam is correct. You cannot subtract 9 ones from 4 ones so you have to unbundle a ten. That changes the problem to 5 tens 14 ones minus 4 tens 9 ones, which leaves 1 ten 5 ones. I think Terry may have forgetten the magnifying glass and flipped the 9 and 4 so she never had to unbundle.

For early finishers:

3. Samantha has 42 marbles and Graham has 17 marbles.

a. How many more marbles does Samantha have than Graham?

S [42]
G [17] ?

$$\begin{array}{r} \overset{3\,12}{\cancel{4}\cancel{2}} \\ -17 \\ \hline 25 \end{array}$$

Samantha has 25 more marbles than Graham.

b. James has 25 fewer marbles than Samantha. How many marbles does James have?

S [42]
J [?] 25 fewer

$$\begin{array}{r} \overset{3\,12}{\cancel{4}\cancel{2}} \\ -25 \\ \hline 17 \end{array}$$

25+17=42

Together James and Graham have the same number of marbles as Samantha!

James has 17 marbles.

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Student Debrief

Lesson Objective:

Relate manipulative representations to a written method.

- How did unbundling a ten help you to solve Problem 1(b)?
- How did you solve Problem 1(c)? How did you use the place value disks on the chart to show decomposing a ten?
- Explain to your partner how you used place value disks to solve Problem 1(d). How did your work with the place value disks match the vertical form?
- How did you solve Problem 1(e) using place value disks and the vertical form? How could you have solved this problem differently using a simplifying strategy?
- For Problem 2, explain to your partner how you know who is correct, Terry or Pam?
- How does Problem 3(a) help us to solve Problem 3(b)?

Exit Ticket

Sherry made a mistake while subtracting. Explain her mistake.

Sherry's Work:	**Explanation:**
$\begin{array}{r} {\scriptstyle 14} \\ 44 \\ \underline{-26} \\ 28 \end{array}$	______________________ ______________________ ______________________ ______________________ ______________________ ______________________

APPENDIX J

DIGITAL PRESENTATION 3RD GRADE MODULE 1 LESSON 12

Engage NY 3rd Grade Presentation

Module 1
Lesson 12

Objective:

Interpret the quotient as the number of groups or the number of objects in each group using units of 2.

Teach the Way They Learn

Fluency Practice

Multiply by 3 Pattern Sheet 3.OA.7

Materials: (S) Multiply by 3 (6–10) (Pattern Sheet)

Note: This activity builds fluency with multiplication facts using units of 3. It works toward students knowing from memory all products of two one-digit numbers. See Lesson 9 for the directions for administering a Multiply-By Pattern Sheet.

$$6 \times 3 = \_\_\_$$

Let's skip-count up by threes to solve.

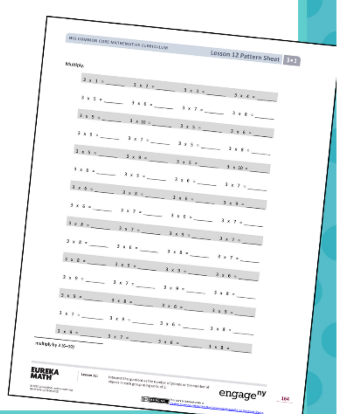
Let's skip-count down to find the answer, too.

Start at 30.

Repeat the process for 8 × 3 and 7 × 3.

Let's practice multiplying by 3.

Be sure to work left to right across the page.



Fluency Practice

Group Counting 3.OA.1

Note: Group counting reviews interpreting multiplication as repeated addition. Counting by twos and fours in this activity reviews multiplication with units of 2 from Topic C and anticipates using units of 4 in Topic E.

Up Down Stop

Let's count by twos.

(Direct students to count forward and backward to 20.)

Let's count by fours.

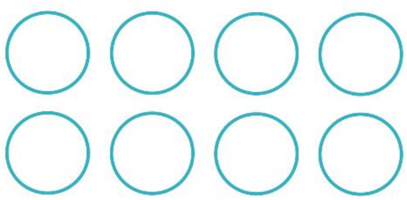
(Direct students to count forward and backward to 36.)

Fluency Practice

Divide 3.OA.7

Materials: (S) Personal white board

Note: This activity builds fluency with multiplication and division. It works toward the goal of students knowing from memory all products of two one-digit numbers and reviews the objective of Lesson 11.



Draw an array to match my picture.

Skip-count by twos to find how many total objects there are.

How many groups of 2 are there?

Say the total as a multiplication sentence starting with the number of groups.

$4 \times 2 = 8$

$8 \div 4 =$ ___

Fill in the blank to make a true division sentence.

Then, divide your array into 4 equal groups to find the answer.

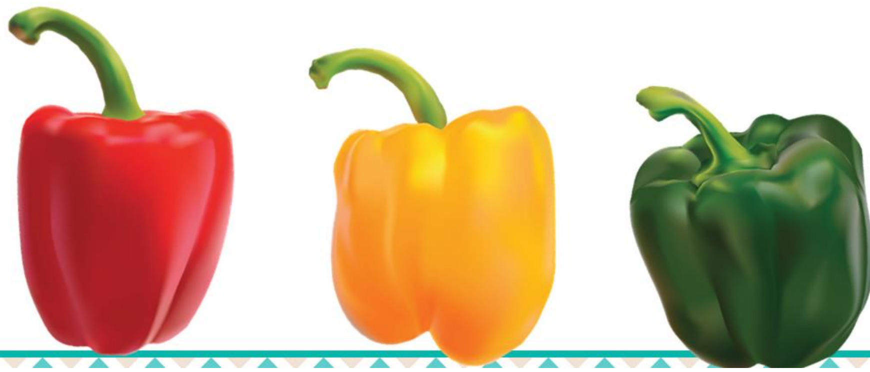
Erase the lines that divided the array.

Show $8 \div 4$ by making groups of 4.

Repeat process for the following possible sequence: $9 \div 3$, $12 \div 2$, and $12 \div 3$.

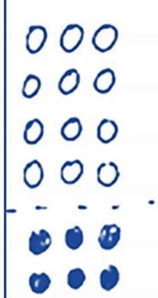
Application Problem

A chef arranges 4 rows of 3 red peppers on a tray. He adds 2 more rows of 3 yellow peppers. How many peppers are there altogether?

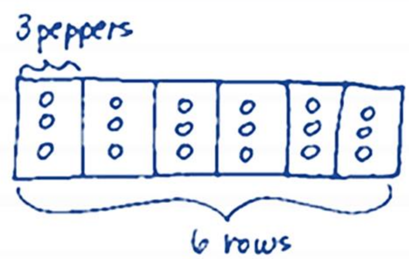


Application Problem

A chef arranges 4 rows of 3 red peppers on a tray. He adds 2 more rows of 3 yellow peppers. How many peppers are there altogether?



$(4 \times 3) + (2 \times 3) =$
$12 + 6 = 18$



$6 \times 3 = 18$

There are 18 peppers.

Concept Development

Materials: (S) Personal white board

Problem 1: Model division where the unknown represents the number of objects in each group.

Two students equally share 8 crackers.

How many crackers does each student get?

Draw to model and solve the problem.

Then, explain your thinking to your partner.

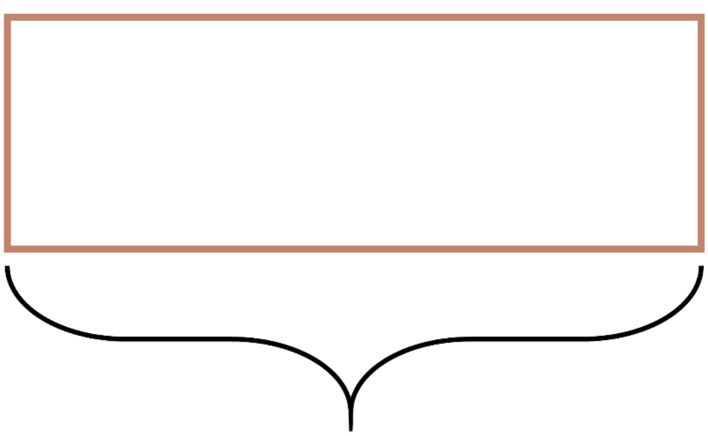
Write a division sentence to represent your model.

Concept Development

This diagram represents the total, 8 crackers.

In your mind, visualize where we would divide it to make 2 equal parts.

Say "Stop!" when I get to the spot you have in mind.



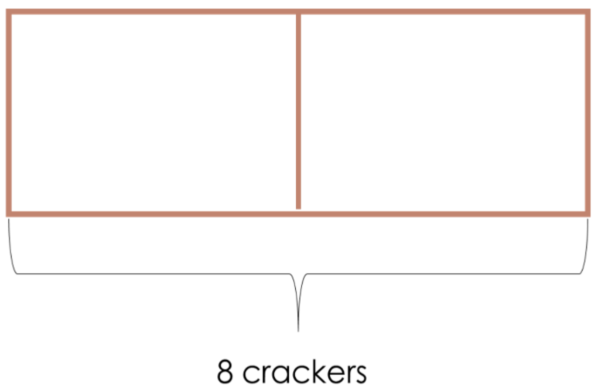
8 crackers

Concept Development

How does the diagram represent the students?

What is our unknown?

Watch how I label the unknown on the diagram.



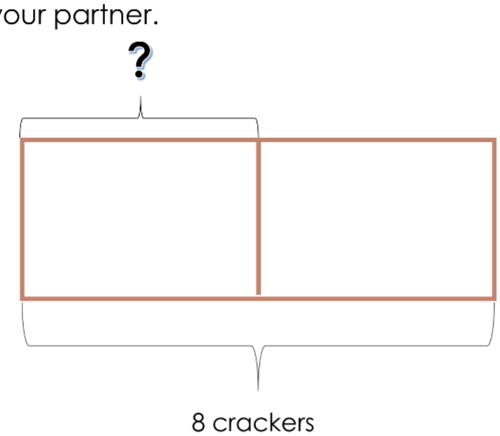
Concept Development

Tell your partner a strategy for finding the unknown using the diagram.

Look at the division sentence you wrote for your first model.

Does it represent this diagram too?

Explain to your partner.



Repeat the process with the following suggested expressions to model division where the quotient represents the number of objects in each group.

- *12 ÷ 2*
- *18 ÷ 2*

Concept Development

Problem 2: Model division where the unknown represents the number of groups.

Let's go back to our original problem, this time changing it a bit.

There are 8 crackers, but this time each student gets 2.

How many students get crackers?

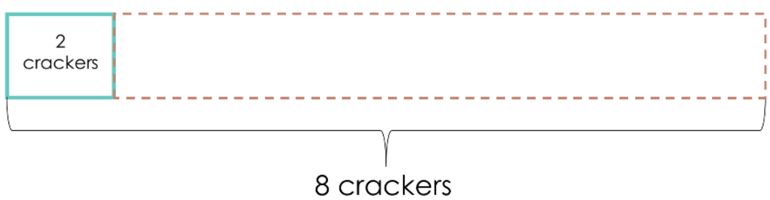
Do we know the size of the groups or the number of groups?

We can draw 1 unit of the diagram to represent a group of 2 crackers.

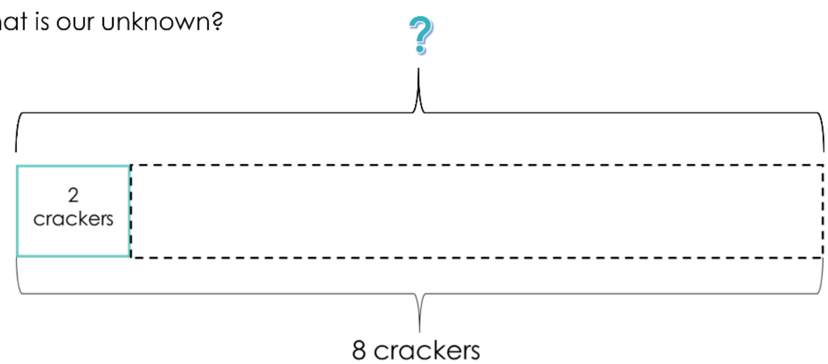
Concept Development

What other information does the problem tell us?

Notice that I drew a dotted line to show the whole diagram.



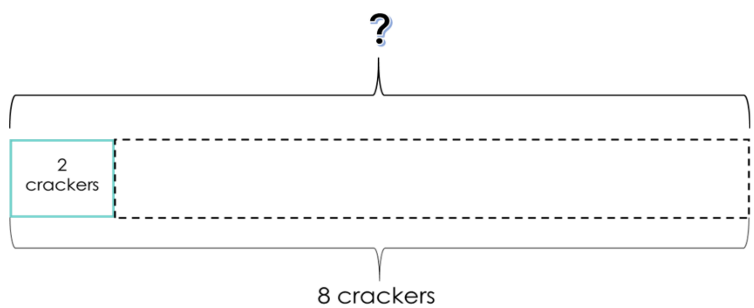
What is our unknown?



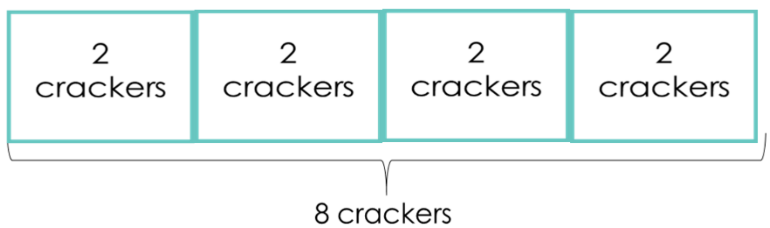
Concept Development

Let's find the number of groups by drawing more units of 2.

How will we know when we've drawn enough units?



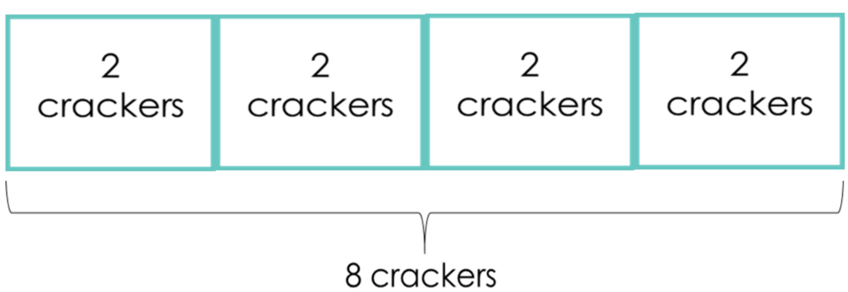
Draw along with me on your personal white board.



Concept Development

Whisper to your partner the number of students that get crackers.

Write a division sentence to match the diagram.



Repeat the process with the following suggested expressions to model division where the unknown represents the number of groups.

- *12 ÷ 2*
- *18 ÷ 2*

Concept Development

In this lesson, three division sentences are each modeled with two types of division. Use one pair of division sentences for the following reflective dialogue.

$$8 \div 2 = 4$$

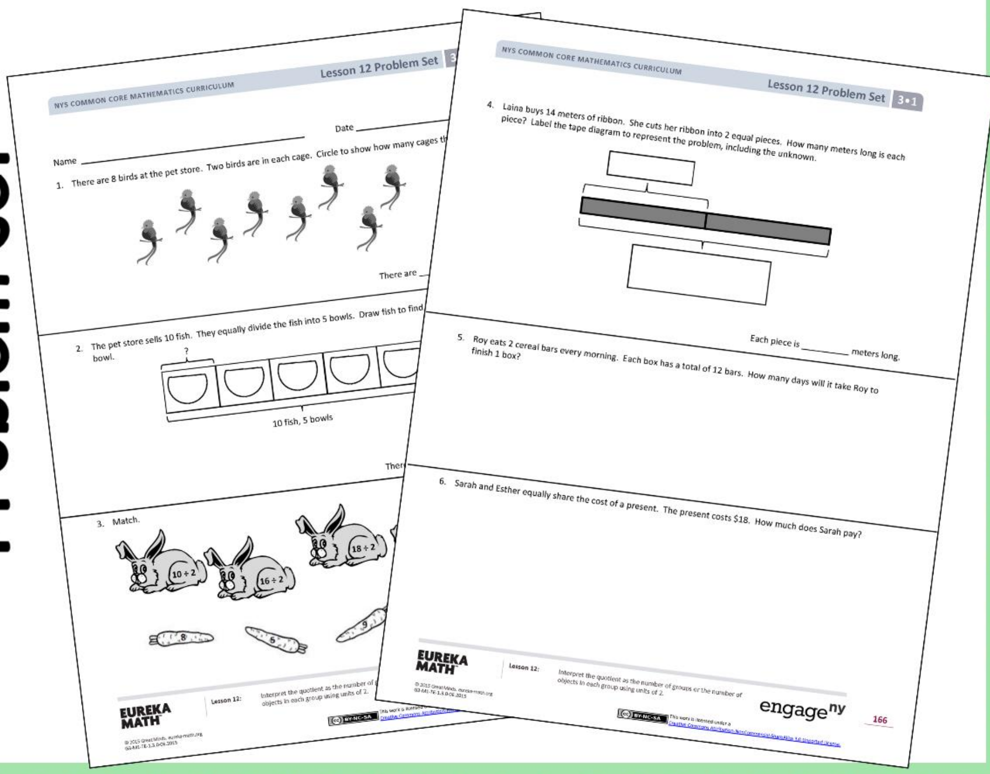
The two division sentences for these diagrams are the same, but the tape diagrams are different.

Turn and talk to your partner about why.

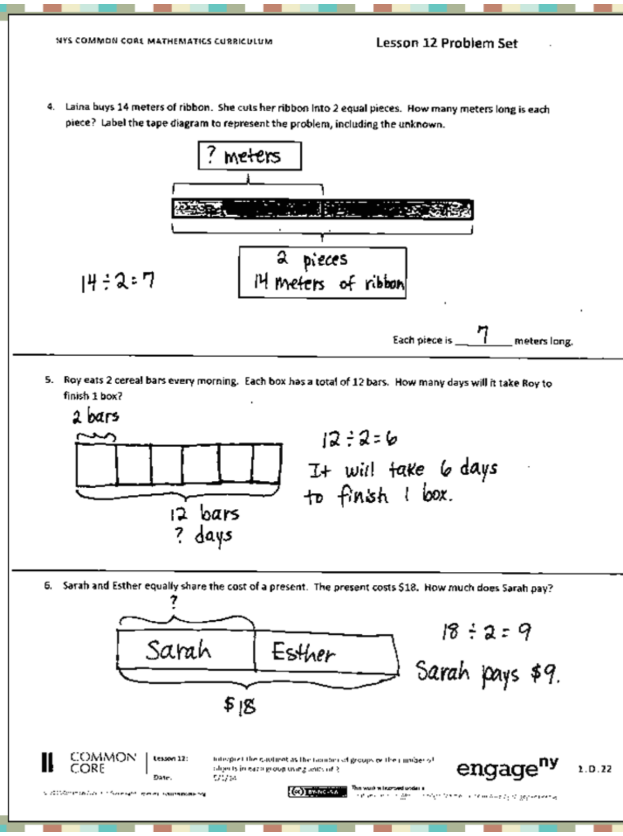
When we divide, we always know the total number of objects.

We divide either to find the size of the groups, like in the first problem, or the number of groups, like in the second problem.

Problem Set



Problem Set



4. Laina buys 14 meters of ribbon. She cuts her ribbon into 2 equal pieces. How many meters long is each piece? Label the tape diagram to represent the problem, including the unknown.

? meters

2 pieces
14 meters of ribbon

$14 \div 2 = 7$

Each piece is 7 meters long.

5. Roy eats 2 cereal bars every morning. Each box has a total of 12 bars. How many days will it take Roy to finish 1 box?

2 bars

12 bars
? days

$12 \div 2 = 6$

It will take 6 days to finish 1 box.

6. Sarah and Esther equally share the cost of a present. The present costs $18. How much does Sarah pay?

?

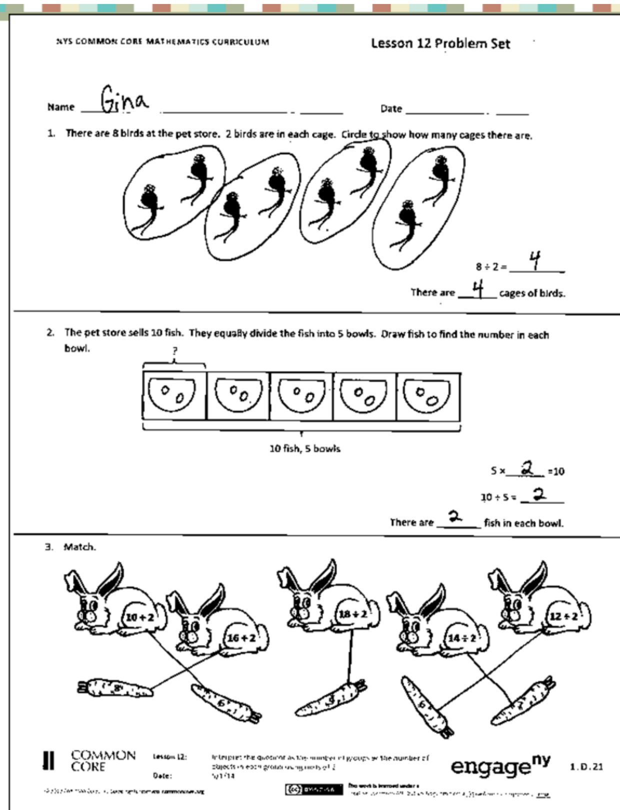
Sarah | Esther

$18

$18 \div 2 = 9$

Sarah pays $9.

Problem Set



Name Gina Date

1. There are 8 birds at the pet store. 2 birds are in each cage. Circle to show how many cages there are.

$8 \div 2 =$ 4

There are 4 cages of birds.

2. The pet store sells 10 fish. They equally divide the fish into 5 bowls. Draw fish to find the number in each bowl.

?

10 fish, 5 bowls

$5 \times$ 2 $= 10$

$10 \div 5 =$ 2

There are 2 fish in each bowl.

3. Match.

Student Debrief

Lesson Objective:

Interpret the quotient as the number of groups or the number of objects in each group using units of 2.

- Describe how you labeled the tape diagram in Problem 4. The number 2 appears in the problem; where do you see it in the diagram?
- Analyze Problems 1 and 2 on the Problem Set to compare different unknowns. (There are 2 birds in each cage in Problem 1, and 2 fish in each bowl in Problem 2.)
- How does what the quotient represents affect the way a tape diagram is drawn?

Exit Ticket

There are 14 mints in 1 box. Cecilia eats 2 mints each day. How many days does it take Cecilia to eat 1 box of mints? Draw and label a tape diagram to solve.

It takes Cecilia______days to eat 1 box of mints.

APPENDIX K

IRB APPROVAL LETTER

EXEMPTION GRANTED

Molly Ott
Division of Educational Leadership and Innovation - Tempe
-
Molly.Ott@asu.edu

Dear Molly Ott:

On 7/18/2018 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Translating Teacher's Manuals into Digital Presentations: PowerPoint Presentations as Educative Curriculum Materials
Investigator:	Molly Ott
IRB ID:	STUDY00008514
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	• Facebook Note to Teachers - Perceptions of PowerPoint Presentations.pdf, Category: Recruitment Materials; • Interview Recruitment - Perceptions of PowerPoint Presentations.pdf, Category: Recruitment Materials; • Questionnaire Recruitment - Perceptions of PowerPoint Presentations.pdf, Category: Recruitment Materials; • Perceptions of PowerPoint Presentations, Category: IRB Protocol; • Intervention Example - PowerPoint slides for 1st Grade Module 6 Lesson 11, Category: Participant materials (specific directions for them); • Questionnaire - Perceptions of PowerPoint Presentations.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

	• Interview Guide - Perceptions of PowerPoint Presentations.pdf, Category: Measures (Survey questions/Interview questions /interview guides/focus group questions);

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 7/18/2018.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Sincerely,

IRB Administrator

cc: Rebecca Freauff
Rebecca Freauff

APPENDIX L

INTERVIEW QUESTIONS

1. Would you tell me a little about your background in education and describe your current teaching environment?
2. How would you describe the impact that using the PowerPoint presentations provided in this study had on your lesson planning and preparation? Please be as specific as possible.
3. How would you describe the impact that using the PowerPoint presentations provided in this study had on your lesson pacing? Please be as specific as possible.
4. Did using the PowerPoint presentations help you to improve your own content knowledge of Engage NY math? If so, why? If not, what do you believe could have helped you?
5. Did using the PowerPoint presentations provided in this study help you to explain mathematical concepts more clearly to your students? Why or why not?
6. Did using the PowerPoint presentations provided in this study aid in your student's learning? Why or why not?
7. Are you offered any type of professional development by your school or district to help you create your own digital presentations? If so, please briefly describe any sessions you have attended.
8. Would you be interested in receiving the rest of the presentations to continue using in your classroom? Why or why not?
9. Any other comments?

APPENDIX M

PRE-INTERVENTION SURVEY RESPONSE FROM ALL 34 PARTICIPANTS

How do you prepare to teach an Engage NY math lesson? Check the option that most closely resembles your process.

	Number	%
I skim the lesson in the teacher's manual for key ideas before I teach the lesson.	6	17.6
I read the entire lesson in the teacher's manual before I teach the lesson.	14	41.2
I skim the teacher's manual for key ideas during the lesson.	2	5.9
I use digital presentations to present the content.	5	14.7
Other (please explain):	4	11.8

How do you prepare to teach an Engage NY math lesson? Check the option that most closely resembles your process. - Other (please explain)

At this point I skim the lesson prior to teaching. I will often re-watch the videos by Duanne Habecker from youtube. I have been using the embark PP while teaching.

I do a mix of skimming before and during to make sure I am hitting all key ideas

I don't know since I haven't taught a lesson yet. I probably will read the entire lesson before teaching.

My first year so not sure. I plan to read the entire lesson before and use digital presentations to teach key components with my students.

Participant Age Range – Initial Data Collection Pre-Intervention Survey

	Number	%
25 - 34	9	26.5
35 - 44	13	38.2
45 - 54	7	20.6
55 - 64	5	14.7

Participant State of Employment – Initial Data Collection Pre-Intervention Survey

AZ	Number	%
AR	4	11.8
CA	3	8.8
FL	5	14.7
GA	1	2.9
IL	1	2.9
KS	2	5.9
LA	1	2.9
MD	3	8.8
MO	1	2.9
NV	2	5.9
NY	1	2.9
NC	1	2.9
OH	2	5.9
PA	2	5.9
UT	2	5.9
WA	1	2.9
WI	1	2.9

Participant Years Teaching - Initial Data Collection Pre-Intervention Survey

	Number	%
This is my first-year teaching in the classroom.	1	2.9
1-3 years	4	11.8
4-6 years	6	17.6
7-9 years	7	20.6
10 or more years	16	47.1